

# Popular Mechanics

JUNE 1980 \$1.25

**SOLAR INSTALLATIONS:**  
How you can avoid  
blunders and rip-offs

**188-MPH SPORTS PLANE**  
you build from plans & kits

## **FOUR-WHEEL DRIVE:**

- PM tests Datsun's new mini pickup
- Owners Report: Love the Jeep CJ-5 and 7

**TV: 8 home cures**  
for wiggles,  
ghosts and  
snow

**DARING CHALLENGE:**  
**MACH.5**  
**ON WATER**

## **BUILD FOR SUMMER**

- **COMPLETE PLANS:** Construct this classic colonial cupola
- **STEP-BY-STEP:** Weave this great rope hammock
- **HOW-TO:** 4 lattice garden retreats to make
- **PLUS:** Build our kids' foldaway art center





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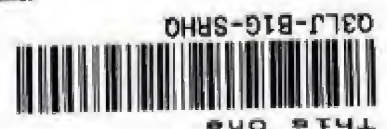
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**Trucks are what we're all about.**

More and more people are discovering that a van pool is a great way to lower the cost of getting to work. By sharing gasoline, insurance, and other expenses, each person realizes a big saving in transportation cost. Even with gas over a buck a gallon, splitting the cost among a vanful of friends works out to a pretty cheap ride.

And for van pooling at its comfortable best, we respectfully suggest the GMC Rally Wagon. It offers many of the carlike options to which you've become accustomed. Tilt wheel. Cruise Control. Air. Stereo. And other passenger-pampering luxuries. But unlike a car, it carries five passengers in its standard configuration, or up to 12 with available second and third seats. Also uncarlike, a convenient, sliding side door opens wide for easy getting in and out.

All in all, the GMC Rally Wagon offers an excellent opportunity for you and your co-workers to start your own private "bus system," one that operates on your timetable and never requires anyone to stand in the aisle. And when you compare the per-person cost with that of driving individual cars to work, well, there's simply no comparison.

So, get the gang together and talk to your GMC dealer about buying or leasing a GMC Rally Wagon.



GMC is  
a division of  
General  
Motors







### On the cover

In a radically designed craft housing a full-blown rocket engine, driver Lee Taylor is trying to capture the world's on-water speed record—and may even push his boat to half the speed of sound (350-plus mph). Read how the design evolved on page 73.

—PM painting by Ed Valigursky

# Popular Mechanics

JUNE 1980

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Read the facts about the paint that beat the Weatherbeater at your Olympic dealer.

It's all the evidence you'll need to buy Overcoat.

## Olympic Overcoat®



*Tests were conducted by D.L. Laboratories of New York City.*



# LETTERS TO THE EDITOR

## A fleet of Fleets

In the April issue on page 107 (*Saving Lindbergh's First Plane*), you identify the biplane in the upper left photo as a Jenny. It is a Fleet biplane, powered by a Kinner five-cylinder engine. The correct name for it is a Consolidated Husky Jr.

JOSEPH B. WITKIN  
PORTLAND, CONN.

I spent several years at the new Roosevelt Field in the mid-'30s where I obtained my A+E license and maintained the Roosevelt Aviation School aircraft. The Fleet airplane pictured was No. 7 of a group of nine or 10 similar trainers used by the school, along with a five-place open cockpit Standard biplane, two Aristocrats, a Fairchild 24 and a Stinson for flight training. I worked on all of them, and flew them on test flights after repairs or checks.

The photo appears to have been taken after 1929 at the old Curtiss Field, where the school moved after

the old Roosevelt Field was converted to an auto-racing course in the mid-'30s. The hangar in the upper right corner of the photo was destroyed in a fire shortly after the picture was taken, I believe.

RAYMOND C. POMASKI  
FALLS VILLAGE, CONN.

## Crowning achievement

In *Archimedes Would be Amazed* (*PM Briefs*, page 62, April '80), you state that the 12-foot-diameter screws were fabricated by Enviro Development Co. The screws were designed by EDC but were actually built by Crown Iron Works of Minneapolis. The screws weigh approximately 57,000 pounds each.

GARY D. SKELLENGER  
CROWN IRON WORKS  
MINNEAPOLIS

## Row, row, row your bike

The Australian bike (*PM Briefs*, page 61, Apr. '80) is not really all new. It is a version of the four-

wheeled "Irish Mail." That model was steered with the feet on the front axle. Forward movement was produced by a rowing motion. Haven't seen any in many years—maybe it's time to bring it back. Keep up the good work.

FRANK WHITTLE  
PHILADELPHIA

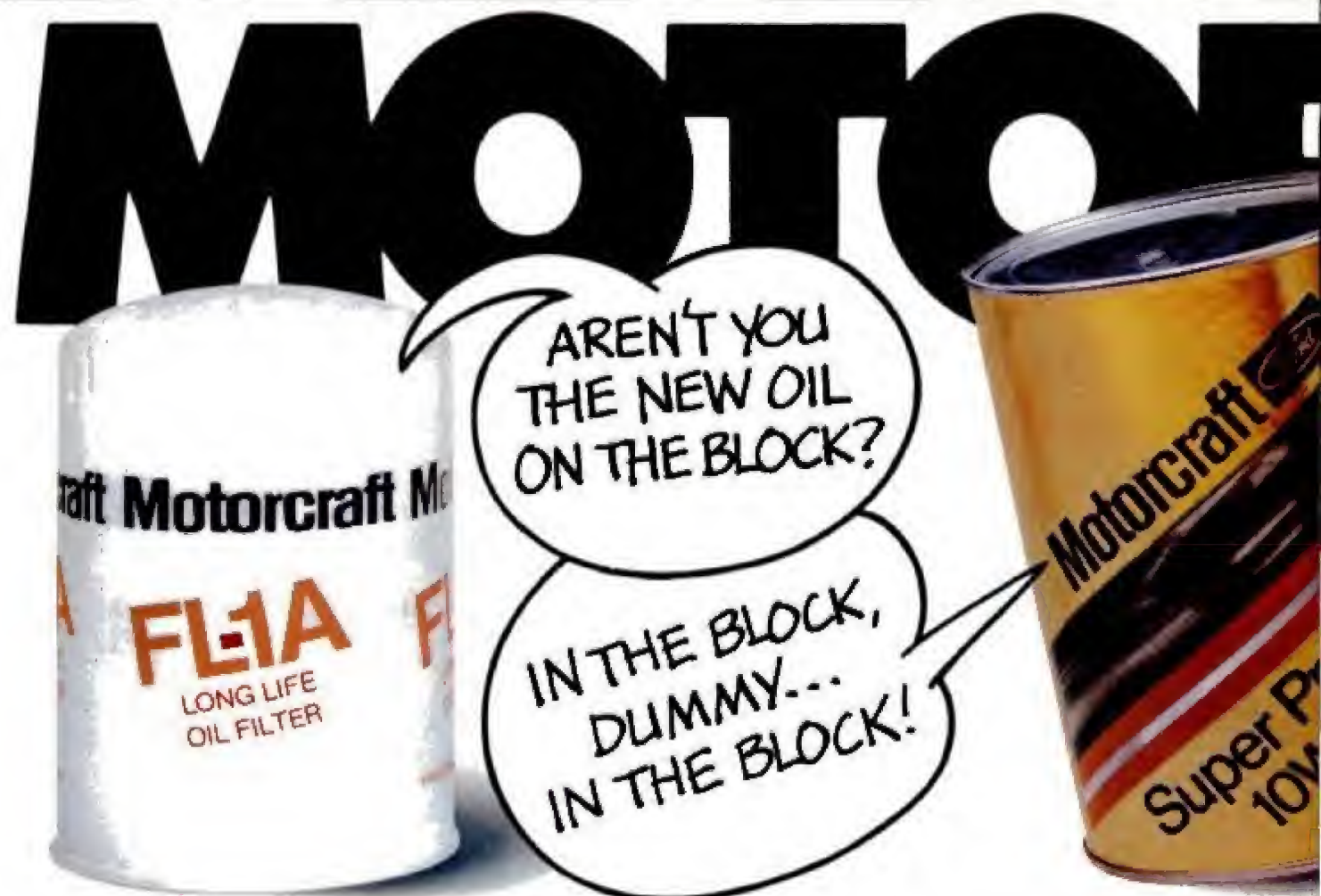
## Can't find the handle

We very much enjoyed *Get the Big Picture: Pick of the Projection TVs* (page 104, Feb. '80). However, on page 105 in the upper right-hand corner, you show a couple playing the Atari Video Game. Unfortunately, this game (*Roadrace*) calls for a control stick different from the one they are using. They must be having a difficult time!

TOM AND MIKE WOLF  
SPRINGDALE, OHIO

## Danger warning

While we agree that with a cab, snow removal can be "almost fun"





(*Homebuilt Tractor Cab Takes the Bite Out of Snowblowing*, page 76, Feb. '80), a word of caution is in order. Carbon monoxide build-up in such cabs can be significant. Exhaust-outlet modifications to minimize CO concentrations should be tested with accurate monitoring equipment. The vertical pipe and muffler shown in the photographs is of a kind not usually found on lawn and garden tractors. There are numerous complications with such a modification, not the least of which is that it does not guarantee a safe CO level inside the cab.

D.J. BURKHARDT  
SIMPLICITY MFG. CO.  
PORT WASHINGTON, WIS.

### Geronimo!

I have never built an electronic device before, but I tried to build your TV silencer (*PM's Silencer Cuts Off Nagging TV Commercials*, page 162, Jan. '80) just for fun. The device worked and I love it. It's a great idea, but it does have a minor fault. When it is engaged, the only way to shut it off before the time limit has run out is to remove the battery. I spliced what I call a "bail-out switch" into one of the battery leads.

It's a simple on-off switch that allows you to stop the silencing at will.

DAVID WHALEN  
CLEARWATER, FLA.

### Safety first

You are to be congratulated for promoting home security with the article *PM Looks At: Floor Safe* (page 85, Nov. '79). I am a strong advocate of money safes being installed in the floor, embedded in concrete, under the carpet, for security as well as fire protection of personal property at home. However, your lead photo, with papers shown inside the safe coupled with the comment "peace of mind," is misleading. The safe shown, because of its design, will not protect the contents from fire damage. A comment like "not rated for fire protection" would have been appropriate.

EDWARD H. BARR  
NIPOMO, CALIF.

### Can't fuel him

I like the approach of your articles on muscle-powered yard tools, lightweight RVs, towing with compacts and so on; all are oriented toward using less fuel. Going "camping" in a 35-foot vehicle is a joke. After trying them all, I've gone back to car camp-

ing, with a hatchback that gets 35 mpg.

I feel closer to nature cooking and living outside; if I must have a bathroom and kitchen, I use a motel and get more satisfaction.

JAMES C. CRITTENDEN  
PORTOLA VALLEY, CALIF.

### Moped rules

In *What You Should Know Before You Start Commuting by Moped* (page 103, Mar. '80), some information was left out of the State Moped Laws table. The table says that any driver's license is sufficient to operate a moped in Pennsylvania. It should read "any driver's license with Class 6 stamped on it." Eye protection is also required on mopeds in Pennsylvania.

BARRY L. MASON  
MODENA, PA.

### Have one in your attic?

We've been searching for a copy of the Dec. 1940 issue of PM. We'd like to purchase one in reasonably good condition.

EDWARD F. KIBBLE  
WALTER DORWIN TEAGUE ASSOCIATES  
NEW YORK, N.Y. 10017

*We're down to our last copy; can any readers help Mr. Kibble?*

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# PM ELECTRONICS MONITOR

## But by any other name?

As the state of the electronic art continues to advance, repair and service technologies must also keep pace. Just as new electronic specialties have called for new vocabularies, so might we need a word for a shop devoted to fixing such specialized circuitry.

The name Digital Repair Service was proposed by Global Specialties Corp. a few months back. Since then, many in the electronics field are recognizing the need for such a specialized repair service.

Computers, clock radios, appliance controls, microwave ovens, thermostats and many other devices depend on off and on pulses to operate. Repairing such equipment calls for special tools, knowledge and education.

So far, specialists in this type of repairs have had no name for what they do, other than electronic repair, and this often makes them hard to find. As digital circuitry increases, perhaps a Digital Repair Service or DRS should be established.

## Computerizing Gutenberg

In 1456, the Gutenberg Bible brought movable typefaces to the world and things have never been the same. Since those days of thick-bodied black-letter type styles, we have seen the bold-and-thin Bodoni styles; the sleek *sans-serifs*; the traditional Romans. In fact, there are hundreds of type styles now in everyday use. They have all had one thing in common—the designer invested many months of his life in balancing the form of every letter to a personal measure of perfection. Some designers have spent a whole lifetime perfecting a typeface.

Stanford University has now put the computer to work as a tool to help in typeface design. New typefaces may soon proliferate at an unheard-of rate.

Donald Knuth invented the computer system which he details in his book *Tex and Metafont: New Directions in Typography*. Herman Zapf (who has hand-designed such popular typefaces as Optima) calls Knuth's computer system a breakthrough.

Simple English-style commands enable the computerized designer to see his new typeface instantly on the computer screen. Each letter can then be manipulated and reformed immediately. Thus, new



## Make your own videotape graphics

Have you ever wished that you could create fancy graphics for your videotape extravaganzas? Well, you don't need to be an artist to do it.

We watched a demonstration of the above method with astonishment. The original design is painted on a transparent overlay, which is

attached to the TV screen. Then the camera is focused on the overlay. Now the image on the TV set consists of both the overlay and what the camera sees. By moving the camera back and forth, up and down, you can literally swirl the original design into a kaleidoscopic array of interlocking letters and graphics. Have fun!

fonts (a font is a complete assortment of type in one size and style) can be created quickly. Knuth only worries whether "font freaks will abuse this toy by overdoing it."

## Video recorder update

Early videotape recorders cannot record/play for nearly as long as the new ones. People who bought them when they first came out are less than happy at how quickly they have been outmoded.

Sony is now offering at least a partial solution, in the form of an automatic videocassette tape changer for their Betamax models LV-1901/D, SL-7200/A, SL-8200 and SL-8600.

For \$125, recorders with this accessory can automatically play three tapes for up to nine hours.

## Curses, Red Baron!

One of the most amazing programs we have yet seen for the home computerist is the FS1—Flight Simulator program from Sublogic. It's the next best thing to flying.

What makes this so unusual is the fully three-dimensional, animated display of the ground. You can land, dive, roll, climb, bank and "see" out the cockpit window, a view that is updated three to five times a second for a very believable movement. You can almost make yourself airsick.

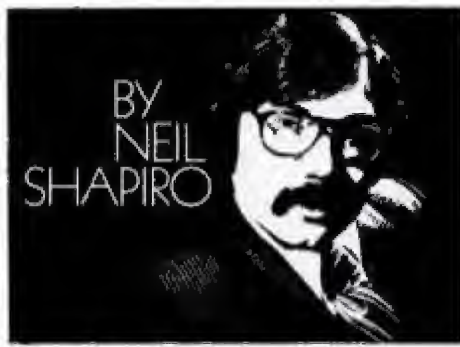
Instruments such as altimeter and airspeed indicator are displayed as moving dials. Control is via the computer keyboard, or with game paddles or optional joystick.

The plane simulated is the venerable Sopwith Camel (although equipped with a radar screen and tricycle landing gear) of World War I vintage. Also simulated are five enemy aces who oppose you on a bombing mission.

More than a game, this is a true simulator. Every aspect of flying seems to be accounted for. After a few hundred hours of on-the-ground flight time, perhaps I'll look for someone who will take me up in a Piper Cub to see what I've learned.

FS1 is available from Sublogic, 201 West Springfield, Champaign, Ill. 61820, for \$25. It will run on an Apple and soon the TRS-80.

PM





# If you don't know roofing, know your roofer. And with Sears you do.

We've had plenty of practice in putting a roof over America's head. In fact, Sears has arranged the installation of thousands upon thousands of roofs in the past 30 years. So we're experts at the job.



We'll make a professional survey of your present roof, to recommend what should be done for best results. We'll also bring along samples of our Sears Glass Fiber Shingles.

Sears Glass Fiber Shingles have the highest fire-resistance rating — Class A — that Underwriters Laboratories can provide.



These shingles are protected with about 75% more weather-proofing asphalt than our conventional felt-based shingles. They resist curling and blistering. So they'll stand up to the weather for years and years.

## Roofing has to be put on right, to protect right.

That's why we can arrange for Sears Authorized Installers to do the job professionally, neatly and thoroughly. That includes making sure your chimneys and vents are properly flashed.

## Or, if you need new guttering...

Sears Continuous Aluminum Guttering and Sears Authorized Installers are your answer. The guttering comes in a choice of durable finishes. It's made right on the job to the exact lengths needed, then checked for pitch, caulked, and fitted with new downspouts.



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*The products and service described here are available at most Sears retail stores.*

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# Salem

Warning: The Surgeon General Has Determined  
That Cigarette Smoking Is Dangerous to Your Health.

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# Lively Light Menthol



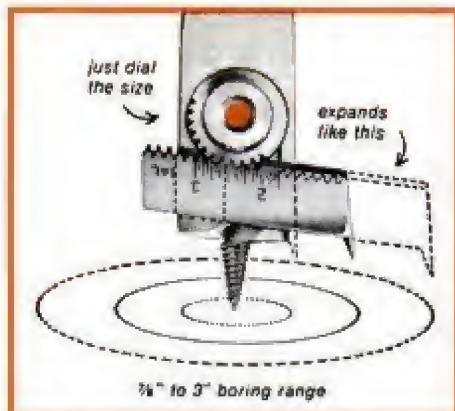
Crisp  
refreshing  
taste in  
a low tar.

# Lights

LIGHTS: 11 mg. "tar", 0.8 mg. nicotine, LIGHT 100's: 11 mg. "tar",  
0.9 mg. nicotine, av. per cigarette, FTC Report DEC. '79.

SALESMAN: 3-800-2-REYNOLDS WITH CIGARETTE P.P.

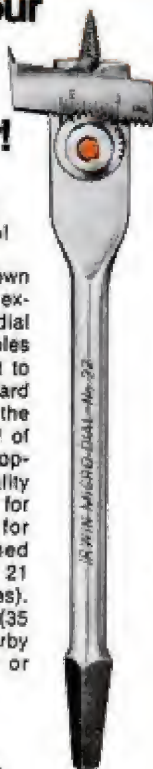




## Irwin makes your 'Popular Mechanics' projects easier!

When you're building a cupola or any summer project, Irwin quality products can help!

There are good reasons to own an Irwin Micro-Dial®... the expansive bit that lets you dial your size. Use it to bore holes up to 3" in any wood. Use it to bore as many as 35 standard hole sizes. Use it and save the cost of a whole tool box full of "single size" wood bits. Drop-forged from finest Irwin quality steel. Precision-engineered for accuracy. Heat tempered for long life. Machine-sharpened to cut fast and clean. No. 21 bores 1/8" to 1 1/4" (19 sizes). No. 22 bores 1/8" to 3" (35 sizes). Buy from your nearby hardware, building supply or home center store.



### More power for small 1/8" drills & drill presses

Now easily bore holes up to 1 1/2" with the Irwin Speedbor® "88" electric drill wood bit. No wobble. No run-out. 1/4" shank chucks perfectly. Exclusive Irwin hollow ground point starts holes faster. Machine-sharpened cutters bore faster and cleaner. Forged in one-piece from Irwin quality tool steel. Heat tempered to last. 17 sizes. 1/8" to 1 1/2". Also available in attractive red plastic roll sets, 4, 6 and 13 bits.

### Workshop special

Set of 5 Speedbor "88" bits with metal hang-up rack. Sizes 1/8", 1/4", 3/8", 1/2", 1". No. 886M.



### Strait-Line®

Chalk Line Reel Box—50 ft. & 100 ft. sizes. Popular-priced Irwin self-chalking aluminum alloy box. Easy action reel. Leak-proof. Practically damage-proof. Fits pocket or hand. © Registered U.S. Patent Office



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at Wilmington, Ohio 45177, since 1885

# THE PM GARAGE REPORTS ON NEW AUTO PRODUCTS

## The gloves, please

They laughed at me at the garage when I slipped on my Playtex rubber gloves. Mechanics aren't supposed to be afraid of dirty hands. But my feeling is: Why go out of your way to get greasy?

Barbed comments aside, I found



Super-grippy gloves let you handle even the greasiest parts. They are impervious to most automobile solvents and cleaners.

the heavy-duty Playtex gloves extremely useful for really dirty jobs. I tested them in the solvent bath while degreasing an old intake manifold and fuel pump. I was surprised to find they were very grippy. They also stood up to solvent. They cost \$2.99 wherever Playtex products are sold.—T.A.

## Carb gauge set



Universal carburetor gauge set can be used for work on any American-made carb.

If you've ever tried to overhaul a carb without the right equipment, you know what a chore it is. Kent-Moore seems to have solved the

problem of getting your hands on the right tools with a Universal Gauge Set (part No. 9789-C).

The set, in a handy plastic case, includes 32 wire gauges; eight plug gauges; four flat gauges; an adjustable sliding scale for float-drop measurements; a linkage bending tool; two float-level gauges; and a choke-angle gauge. There's also an adjustable carb stand so you can work on the carb with both hands. Set is priced at \$67.20 by Kent-Moore, 29784 Little Mack, Roseville, Mich. 48066.—T.A.

## Minigauges

Dashboards are getting smaller and ever more crowded with idiot lights. To really keep track of all your engine's functions, you need gauges, but sometimes that requires drilling



Plumbing and adapters make installation possible on all standard-thread engines.

holes in the dashboard or making up some special brackets. One solution might be to install the Stewart-Warner Mini-Panel.

The three gauges—voltmeter, water temperature and oil pressure—are the size of quarters and are housed in a plastic case measuring 4 inches wide, 2 inches high and 2 inches deep. The gauges are internally illuminated and, despite the small size, are very legible. The Mini-Panel costs \$59.95 and is available in most auto-parts and accessories outlets.—T.A.

## Plug blaster

No matter how good you are at scraping and cleaning dirty spark-plugs, you can never get the result that a fine sandblaster would turn out.

Up to now, the one drawback to buying a sandblaster was the cost

(Please turn to page 176)





# Monro-Magnum.<sup>®</sup> The ride keeps going after the road stops.

It's one thing to ride good on a smoothly paved highway. But it's a whole different ball game to also ride good when you're miles from anything that even resembles a road.

That's why we make Monro-Magnum<sup>®</sup> shocks.

Compared to the one-inch shocks that are standard on most pickups, 4x4s and vans, they're huge. Their bore is bigger. Their piston's bigger. And they've got nearly twice the oil capacity. To give you a ride that's far firmer and much more stable. Both on road and off.

In fact, we're so sure no standard shock will ride as well as Monro-Magnum, either on or off road, we're making this special



offer: If in 60 days you don't agree four Monro-Magnums give you the best ride ever, Monroe will replace them, no charge, with any comparably-priced shocks. Offer extended to October 31, 1980. See your Monroe dealer for details.

So how about it? Get a set of Monro-Magnums and give 'em a real workout. You'll find the ride keeps going, and going and going.

Monroe Auto Equipment  
Divisions of Tenneco Automotive



**AMERICA  
RIDES  
MONROE<sup>®</sup>**



# PM WORKBENCH

## PM EXAMINES PRODUCTS & SERVICES

### Super sealer

Flecto now offers a sealer and clear finish made with its exclusive Envirosol system. The Varathane formulation is designed to penetrate wood fibers and achieve long-lasting stability. The result, the maker claims, is a reduced tendency of wood to ex-



Durability, quick drying and water cleanup are main advantages of Varathane Sealer.



The milky appearance is short-lived; it turns clear upon contact with the wood.



The top coat has a slight ambering effect, which brings out the beauty of the wood.

pand and contract with atmospheric changes.

The clear finish is available in gloss and satin, and dries up to three times as hard as a conventional varnish. Cleanup is with water. Made by Flecto Co., Oakland, Calif. 94604.—Rosario Capotosto

### Stick with this one

The maker of Zar wood finishes has recently developed a strong, fast-drying glue that is perfect for all facets of woodworking, including cabinetry, toymaking, crafts and picture-frame making. It sets strong



Woodworking glue is available in quart bottles (left), also in 4-oz., 8-oz. and gallon containers.

enough for work to be unclamped in 30 minutes; that means clamps can be moved to next project. It reaches maximum strength overnight, and is available at hardware stores and home centers, from United Gilsonite Laboratories, Scranton, Pa. 18501.—H.W.

### Router know-how

A new handbook describing how to use a portable router has been published by Black & Decker, the tool manufacturer. Priced at \$4.95 and sold through dealers handling Black & Decker tools, the 160-page manual includes over 125 photos and diagrams.

I particularly like some of the author's ideas for making fixtures that let you get more use from the tool. If



Well-illustrated book is handy reference.

you can't get the book locally, write Black & Decker Mfg. Co., 701 East Joppa Rd., Towson, Md. 21204. Ask for No. 76300.—H.W.

### Books for your workshop

Frequent queries from readers indicate that today's how-to book buyer is becoming more discriminating. And he should. In my opinion, too many publishers offer do-it-yourself books of questionable value. Happily, there are a number of first-rate books around. Here are several that



Rockwell's series has nine book titles.

are worth considering for your workshop collection:

■ *Getting the Most Out of . . .* is a series from Rockwell Publications, 1004 East Brooks Rd., Memphis, Tenn. 38116. Each 128-page book deals with one subject; the first nine editions cover the table saw, drill press, bandsaw, radial saw, abrasive tools, three books of projects and finishing. Price is \$6 per book, postpaid.

■ *Creative Woodworking*, Dremel, Div. of Emerson Electric Co., 4915 21st St., Box 518, Racine, Wis. 53406. The book features more than 150 woodworking projects, ranging from a simple jigsaw puzzle to complex one-piece candelabra. The \$6.95 price tag includes postage.

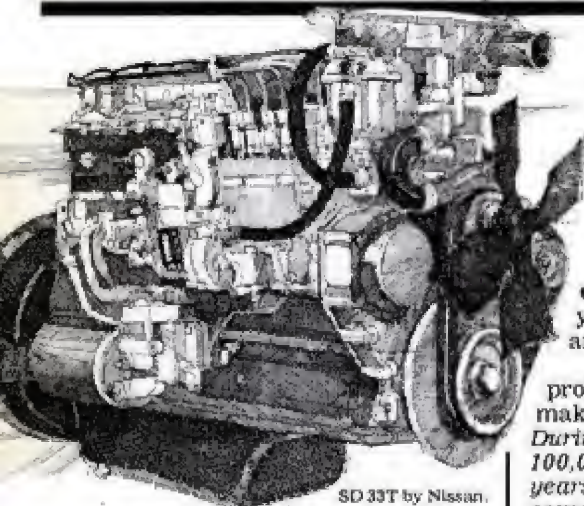
■ *Do-It-Yourself Heating Supply Shop*, Solar Components Div., Kallwall Corp., Box 237, Manchester, N.H. 03105. This \$2 catalog is claimed to list everything required to design and build an efficient solar-energy system; most items are carried in stock for quick delivery. Catalog is available for \$2 postpaid from the above address.—H.W.

If you've come across a new product with some special features let us know about it. Write to PM Workbench, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019.



**FIGHT BACK AGAINST RISING GAS COSTS.**

# SCOUT® INTRODUCES THE WORLD'S FIRST TURBOCHARGED DIESEL WITH A 100,000 MILE WARRANTY.



SD 33T by Nissan.

The new International Scout Turbo-Diesel engine gives you all the economy

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**22** EPA EST MPG    **24** EST HWY MPG

Remember use estimated mpg for comparison only. Mileage varies with speed, weather, trip length and your use of 4WD. Actual highway mileage will probably be less.

and dependability of a diesel with startling acceleration. Power to pass. Extra power when you want it...and need it most.

Diesel engines never need costly tune-ups, because they have no spark plugs or distributor points. Diesel dependability is unsurpassed. Many International Harvester truck engines getting 250,000 miles and more. Add turbocharging and you get the best mileage of any American 4-wheeler.

**The warranty that separates our Turbo-Diesel from the Mercedes 300SD.**

There's a promise that separates the Scout Turbo-Diesel not only from the Mercedes 300SD but from every other diesel car engine in the world. Our exclusive 100,000 mile engine warranty. *During the first 100,000 miles, or 5 years (whichever comes first), International® Scout will repair or replace without charge for parts or labor any*

*part of the engine block and all internally-lubricated engine components which are defective.\**

Every Scout engine is a 100,000 mile engine. From our 196 cubic-inch four cylinder to our 304 cubic-inch and 345 cubic-inch V-8's.

The anti-corrosion warranty that separates Scout from ordinary cars. Scout gives you five years with no-rust-through. Clean and simple.

Our extensive 4-step rust-protection process lets us make this promise:

*During the first 100,000 miles, or 5 years (whichever comes first), International Scout will repair or replace any vehicle body component which suffers "perforation" due to corrosion without charge for parts or labor.\**

**Quality and security go hand-in-hand.**

Our built-in quality will give you a sense of well-being you may never

experience in an ordinary car. It's a secure feeling of sitting in a vehicle that surrounds you with protective steel.

In a Scout you sit higher than a car. A vantage point that lets you see the road ahead more clearly and avoid trouble more easily.

Then there's our selective 4-wheel drive. It gives you the option of easily shifting from economical 2-wheel drive to 4-wheel drive, for extra stability and traction when the road or the weather looks rough.

#### How to fight back.

Before you even consider buying an ordinary car, test drive a 1980 Scout. It's as easy as dialing 800-IH-SCOUT for your local Scout dealer.

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## FIGHT BACK WITH SCOUT.

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\*Warranties are non-transferable, and assume customer's proper care and maintenance. See your dealer for details.



## RISLONE HELPS ENGINES RUN BETTER



RISLONE acts fast to remove power robbing varnish, gum and deposits from engines. And RISLONE has been doing it for more than 40 years . . . That's dependability!

Most drivers feel an improvement in performance within a few miles of driving as RISLONE dissolves and disperses deposits from valve stems, lifters, piston rings and oil passages. The RISLONE treatment lasts, too, because a cleaner engine is better lubricated, runs cooler, longer, and gives better gas mileage.

Road test RISLONE yourself. You be the judge. Venture a dollar or so to find out if engine deposits are cutting your mileage and performance. You'll notice that RISLONE is a real bargain because it costs about the same as products in little cans but replaces a quart of motor oil.

GET RISLONE at your auto merchandise store now. We think you'll become a regular Booster if you give RISLONE a test drive!

Watch for these RISLONE super racers at your favorite drag strip . . . the Fabulous RISLONE Chi-Town Hustler, the stunning new RISLONE Jet of TV Tom Ivo, and the hot competition cars of John Lingenfelter and Bob Marshall!



RISLONE National Championship Racing Jacket . . . \$12.95 prepaid. Quality polyester & cotton wash/wear. RISLONE yellow with black & red emblems & stripes. S, M, L, XL. Send check or money order to: RISLONE Racing Jacket, The Shaler Company, Waupun, Wisconsin 53983

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## NOTES FROM THE EDITOR

*John A. Sillitto*

**L**ee Iacocca, president of Chrysler Corp., has introduced a new facet into the business of selling cars, we see. As you know, he has been spokesman for his firm in recent print and TV advertising. Now, for the first time in some 20 years of PM Owners Reports, we find that the company president ranks as a reason for buying a particular brand. Mr. Iacocca's style convinced at least two recent shoppers to buy the Dodge Mirada (page 90).

Step-by-step construction of projects in PM is such an accepted routine that we sometimes lose sight of the fact that the finished items can have another life after we finish our photography.

Such was the case with our Crayola Desk (page 118), which we knew, crammed full of tantalizing coloring gear donated by Binney & Smith (the Crayola people), just had to go where kids could get their hands on it.

It took only an inspired suggestion, from the staff—and it all wound up in the pediatrics area of Memorial Sloan-Kettering Cancer Center in New York City. We hope it's helping brighten the recreation hours of those spunky youngsters we saw at play there.



Accepting PM's Crayola Desk for the Sloan-Kettering Cancer Center is Diane Pinakiewicz, pediatrics administrator. On hand were Harry Wicks, Home & Shop Editor, and I.

While researching our artificial heart story (page 76), Science Editor Gurney Williams for a moment thought he had the caress that sets hearts beating faster. An artificial organ had suddenly jumped a bit over 100 beats a minute at his touch. His dream shattered when he learned engineer Gus Rosenberg had quietly "shifted" it into high just to display its speed.



Wedding of Dennis and Vonda MacDonald in a Ju 52 flying at 3000 feet over Indian River.

The nearest we've had to a real war correspondent in recent years is Robin Nelson, Executive Editor, who rode shotgun on a Ju 52 during a mock raid on Ti-Co Airport in Florida (page 96). Besides photographing attacking P51s and getting his beard singed during a low-level pass over exploding gasoline "bombs," Robin picked up the assignment of photographing a wedding aboard the pre-WWII German transport.



# Get out of the rat race with your own TV or audio service business.

**NRI will train you at home to service TV, audio equipment, video recorders, car stereo and more. Then show you how to run your own full- or part-time business.**

Why stay stuck in a dead-end job when you can build your own future? You can learn to be a TV, audio and video technician right at home in your spare time. Get the training you need for a new career without quitting your job or traveling to and from night school. NRI makes it happen with exciting career training in TV and audio servicing.

## **Build TV, stereo, professional instruments**

NRI training is practical training. Along with easy-to-digest theory in "bite-size" lessons, you get plenty of actual "hands-on" experience as you build our Master Course's big 25" computer-controlled color TV that lets you program a whole evening's entertainment, AM/FM solid-state stereo with speakers, transistorized volt-ohm meter, 5" triggered-sweep oscilloscope, TV color pattern generator, CMOS frequency



Start in your garage or basement and watch your business grow.



Be an audio specialist servicing home and auto stereo.

counter, and perform meaningful experiments with them and the NRI Discovery Lab.®

## **Business training as well as technical training**

Of course, NRI training gets you ready to enter this field at many levels. You can start by working for an established service company, a dealer, or a manufacturer. But you can start working for yourself, too. NRI lessons show you how to set up and run a full- or part-time business. You learn job costs and billing, even how to set up a complete accounting system. That's how complete the program is.

## **The pros select NRI training**

More than a million students later, NRI is still first choice. A national survey (summary on request) shows that more than half of practicing TV technicians have had home study training, and



Get into the booming video tape recorder market.

among them, it's NRI 3 to 1 over any other school.

You can't beat the value. All in one course you get *both* color TV and audio training, *plus* video cassette and disc systems. Send for our free catalog to see it all.

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You get all this professional equipment, build this 25" (diagonal) computer-programmed TV as you learn.



# Dull tools can hack it



...But, is that what you really want? You'll never know how good a craftsman you can be until you have *really sharp* tools. Isn't it time you quit struggling with dull or average-sharp tools—and brought each tool to its *full potential* of sharpness?

• "The Sharpening Shop"—3 stones—fine, medium and coarse—mounted in revolving carriage. The 2 stones not in use are immersed in oil. Heavy, non-skid base. Cover and pint of oil included.

• Diamond Hone. The ultimate stone! Use indefinitely. Coarse grit.

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_____	3-Stone Set; stone size 4" x 2" x 1/2"	25.80
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## HINTS FROM READERS

### Renewing spring clamps



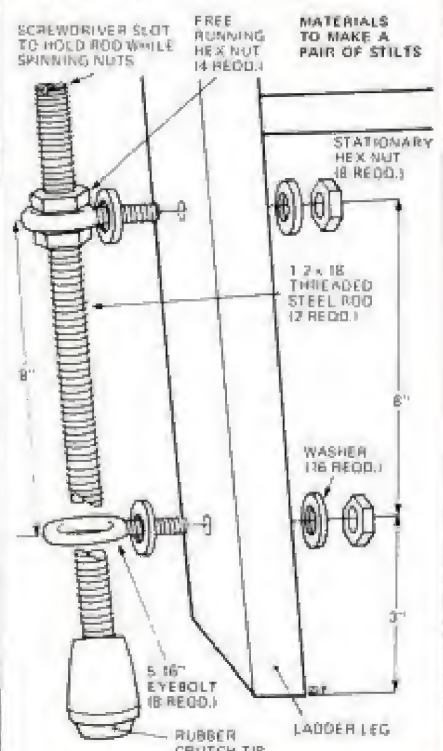
Renew old spring clamps with weakened hinge springs by bending the end of each spring leg so it's at a right angle to the handle (arrow).—A. Weber

### Adjustable stilts



Two hex nuts hold stilt to the ladder.

I use a pair of threaded steel-rod stilts to level my ladder on sloped surfaces. To copy it, install two 1/8-in. eyebolts with two washers and a hex nut on each of the four ladder legs. Adjust the rod, then secure it with two free-running hex nuts. Use one stilt or both as needed.—Andrew Vena







# Olivetti Break- through

*The world's smallest electronic printer will never run out of paper, ink or batteries thanks to Olivetti, JS&A and some incredible new technology.*



*The new pocket-sized Olivetti calculator slides open to unveil one of the most advanced printing heads ever developed.*

It's a major breakthrough. That calculator shown above is the most advanced printing calculator in the world.

## SLIP TOP PRINTER

The new Olivetti Logos 9 is only 1" x 2½" x 4½"—smaller than many cigarette packages. It has a full 12-digit liquid crystal display with add mode and full-floating or fixed position decimal.

To turn the unit into a printer, you simply slide up the top of the unit to expose the world's smallest and one of the most precise printing heads. The printing head prints letters and numbers, identifies each entry and even clearly separates groups of three whole numbers for easy readability.

## PLENTY MORE

If its size and printing head are breakthroughs, so is its paper system. The paper is loaded in special cartridges with enough paper per cartridge for 1300 entries. All you do is simply pop a cartridge into the bottom of the unit each time you change rolls. It's the most convenient way ever designed to change a roll of paper for a printing calculator.

But if you're like most Americans, you'd be concerned about paper supply. Where do you get those special cartridges, and how do you know if you can get them years from now?

That's where JS&A comes in. A 32-roll supply—all you'll ever need for three full years—is only \$16. That's enough paper for 41,000 entries or approximately 52 line entries each working day for three full years.

But even more important, within one year stationery stores will stock the cartridges, and we predict that the Olivetti cartridge will become a standard in the industry.

## NO INK CARTRIDGES

The paper is a new type that looks exactly like conventional paper. But the paper, when struck, leaves a clear sharp image without the use of ink. So there's no messy cartridge required and no space needed to store one. You'll never need ink again.

The rechargeable batteries last for 8,000 lines when you use just the printer and 80 hours using just the liquid crystal display. The batteries can be recharged 500 times, so theoretically the batteries should last for 300 rolls of paper, or more than nine times the life of your paper supply. The batteries can also be easily replaced.

## POWERFUL COMPUTER

The features looked great. The world's smallest size, the paper roll convenience, the no-ink system, the battery life and the large 12-digit liquid crystal display were enough to convince us, but would the new Olivetti be considered a toy? Then we learned about its computational power and features which we feel are better than many of the most professional full-featured printing calculators.

**Speed** It's the world's fastest small printer with a speed of 2.1 lines per second. The unit also has a buffer so if you enter data faster than the unit, it will still print out each entry.

**Memories** The Logos 9 has two separate memories. One is an accumulating memory, and the other is a fully independent memory. And the display and printer indicate which memory is on the paper tape.

**Printing Head** The totally new printing head is a semi-alpha numeric system which labels all entries with letters to indicate the entry. For example LP is list price and CNT means item count.

**Clock** The unit is so complete, Olivetti even threw in a digital clock function. Your unit will display accurate time when the 12-digit display is not in use.

**Gross Margin** It automatically computes everything from gross margins to discounts and retail pricing. You just enter your percentage mark-ups in its memory, and it will automatically compute the results while retaining the formula and percentage in memory.

**Plus More** It has automatic round off, letting you select which figure to round off to. You can add a column of figures and then average your calculations automatically. The full-information liquid crystal display will tell you everything from when you're in the printer mode to whether you have something in memory and in which memory.

The technological breakthroughs in the Logos 9 were possible because Olivetti was able to eliminate the many interface components between the integrated circuit and the printing head. This was all made possible because Olivetti designed the entire system, not just a few of the components as is the case with most calculators.

So there it was. Great features, great convenience and great value for only \$89.95 complete with batteries, charger and 90-day limited warranty. For \$16 more, you can get 32

cartridges—all the paper you'll ever need for three years or for \$10 more you can get 16 cartridges. So impressed are we with the Olivetti Logos 9 that we are making the following offer:

## FREE TRIAL OFFER

We urge you to test the Olivetti Logos 9 now. Order one for our 30-day no obligation trial. See the clear and easy-to-read paper tape and display. Use it as a pocket calculator, and carry it in your briefcase wherever you go. Experience the convenience of always having a printing calculator there whenever you need a permanent record of your transactions.

After 30-days of actual use, decide if you want to keep it. If you do you'll own the smallest, most advanced and convenient pocket printing calculator in the world. If for any reason you're not completely satisfied, simply return your unit within 30-days for a prompt and courteous refund, including your \$2.50 postage and handling. You can't lose.

Olivetti selected JS&A to exclusively introduce this exciting new product. With its solid-state design and high quality printing mechanism, the Olivetti should not require service. But if service is ever required, Olivetti maintains a convenient service-by-mail center as close as your mailbox.

To order your unit for our trial, simply send your money order or personal check for \$89.95 plus \$2.50 for postage and handling (personal check orders, allow 20 days to clear our bank) to the address below, or credit card buyers may call our toll-free number below. Add \$16 for 32 paper cartridges or \$10 for 16 cartridges. (Illinois residents please add 6% sales tax.)

Who would have imagined a printing calculator this small and this convenient with this much computational power just a few months ago? The Olivetti Logos 9 deserves your test. Order one at no obligation, today.

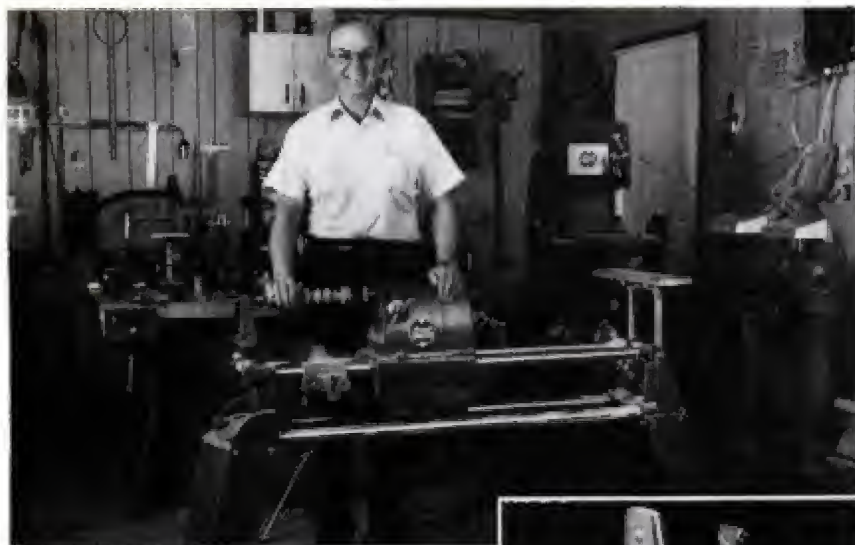
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## Jack McAlister had \$12,000 worth of power tools.



### Here's why he sold them.

"My shop was equipped with commercial tools in which I had an investment of \$12,000 or more. I sold all my machines at a nice profit, and purchased one Mark V... I can do anything I was doing on all the machines, this gives me a lot more room and I have several thousand in the bank. What more could I ask for?"

— Jack McAlister, Tucker, Georgia



Jack McAlister found something out that a lot of woodworkers at all levels already know. You don't need a shop full of expensive power equipment to do just about any job you could imagine. All you need is a Shopsmith Mark V.

#### The 5-in-1 tool that does it all.

The Shopsmith Mark V is actually a complete workshop in a single, compact unit no bigger than a bicycle. It includes the five basic power tools no home shop should be without.

It's powered by a rugged precision-built motor that any power tool owner would be proud to own. And it can do more than your standard power tools because it actually lets you borrow features and set-ups from one tool to enhance the capabilities of the others. So you can tackle jobs you now wouldn't dream of doing yourself. And, thanks to the Mark V's built-in precision and control, you'll do them successfully.

Maybe it's time for you to find out what Jack McAlister and over 350,000 Shopsmith owners already know. Mail the coupon for all the facts today.

Don't you owe it to yourself to find out more about the Mark V — the single piece of equipment that can actually replace \$12,000 or more in power tools — yet costs less than 1/10 that figure?

**The Shopsmith Mark V —  
the tool to start with...  
the system you grow with.**



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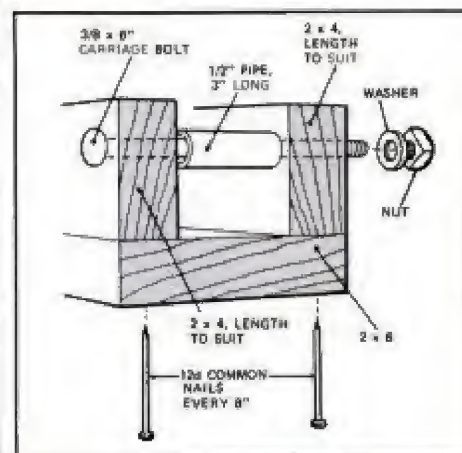
Yes! Please mail me your FREE Information Kit on the Shopsmith Mark V. I understand there is no obligation.

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## Channel carries water off your driveway



Shop-built driveway channel eliminates flooding of the driveway at its low end.



**A**fter a healthy rain, many homeowners have the problem of water running down the driveway into the garage. Lawrence Dodge of Penn Yan, N.Y., solved that problem by building this water diversion channel across his driveway.

For longevity, build the channel of pressure-treated lumber, available at most lumberyards. The rigid trough is constructed of 2x4 sides fastened to a 2x6 bottom piece. To assure that the 2x4s remain vertical, install 3-in.-long pipe spacers over carriage bolts located at 4-ft. intervals.

Install the channel diagonally, midway along the driveway, to divert water rapidly. Imbed the channel so its top edges are flush with the driveway surface. You'll be able to pass smoothly over the channel; yet it will carry surface water to one side of the drive.

To keep debris from entering, you can install heavy fence wire over the channel. You might also paint the top edges a bright color to alert pedestrians. —Ralph Wilkes



# Heart Computer

*Your heart can tell you three things that can help you live longer and stay healthier. The rest is up to you.*

JS&A has never offered a pulse meter. And for good reason.

If you've ever used one, you'll quickly discover that your heart does not beat like a clock. It's irregular. It might beat at 40 beats per minute for one instant and at 120 the next. Since most pulse meters measure each beat as it occurs, you never feel confident that you're getting a very good reading.

We also considered size. Each pulse meter we examined was large or cumbersome and awkward to carry or store.

## WE WAITED

We waited a few years. In the meantime, we discovered three ways your heart (through your pulse) helps you monitor your health.

**Pulse Rate** Your pulse rate can tell you if you are getting enough oxygen throughout your body. A high pulse rate indicates that your heart must pump faster to supply that oxygen and may indicate poor physical condition.

**Target Zone** Your pulse can tell you if your heart is beating fast enough during exercise. There's an area called the "Target Zone." Below this level, you're not exercising hard enough to do your heart or respiratory system any good. Above this level, you can be dangerously over-exercising yourself.

**Cardiac Recovery Time** The time it takes for your pulse rate to return to normal after you've exercised is the real measure of whether or not your exercise program is doing you any good. This time can be as healthy as one minute or as poor as several minutes.

The three things we learned convinced us that the ideal pulse meter must have the following features:

1. It must measure a series of heart beats and simultaneously compute the average to avoid the strange readings from irregular heart beats.
2. It must be small enough to use while exercising.
3. It should have a timing capability to determine the Cardiac Recovery Time.

It wasn't until a small Utah medical electronic instrument company created what we feel not only provides the capabilities listed above, but excels in other areas too.

## FITS ON FINGER

The unit is called the Pulsetach, and it fits right over your finger. It weighs less than an ounce and can be worn easily during most exercise programs.

The large liquid crystal display can easily be seen in normal room lighting or in bright sunlight, and because liquid crystal displays consume very little power, the readily-available watch batteries will last for years. The Pulsetach automatically turns itself off in five minutes if you forget.

The heart of the system is a powerful micro-

computer CMOS semi-conductor integrated circuit that will take up to 4 pulse beats, compute an average pulse rate, and then flash that rate on the liquid crystal display.

## FINGERTIP SCANNER

The sensor consists of a Gallium Arsenide infrared light-emitting diode which scans your fingertip hundreds of times a second to determine your pulse rate. This new system is one of the most accurate and is also used in sophisticated hospital systems.

The unit also contains a quartz-controlled timing circuit which will accurately time either your exercise period or your Cardiac Recovery Time. And you can switch back and forth between the pulse and chronograph mode while you are exercising.

We realize that the Pulsetach sounds like a very sophisticated unit. And it is. But as sophisticated as it is internally, it's an extremely easy unit to operate. There are just two buttons to press which operate the pulse reading and the chronograph timing circuit. A third button engages the audio circuit.



*The Pulsetach system fits comfortably on your finger while it monitors your heart and determines your Cardiac Recovery Time.*

## HEAR YOUR PULSE

The audio circuit simply beeps every time your pulse beeps. This feature lets you monitor your pulse by hearing it as you run or exercise and it can be shut off by pressing the button a second time. The timing circuit is quartz-controlled and extremely accurate.

The Pulsetach not only has combined all of the most advanced technology in an extremely small size, but it costs less than many other systems lacking its advanced features.

The Pulsetach can be used for joggers, athletes, all forms of exercise and even cardiac recovery patients, as it operates quite effectively with pacemakers.

## REAL WORKOUT

We suggest you order a Pulsetach for our 30-day no-obligation trial. When you receive your unit, give it a real workout. Notice how simple it is to operate and how easily you



*The Pulsetach will shortly become the number one selling system of its type in the nation.*

can read your pulse rate. Use it to stay in your Target Zone and to determine and then improve your Cardiac Recovery Time.

Monitor your Cardiac Recovery Time. Determine your Target Zone and see if you're really exercising in that area. Then use the Pulsetach to watch those important signs slowly improve thanks to the accuracy and information you get from the unit.

By knowing the important factors that help you monitor your health, you'll feel better, exercise more effectively, and many doctors feel you'll live longer.

## TWO UNITS AVAILABLE

To order your Pulsetach pulse meter, send your check for **\$119.95** plus \$2.50 postage and handling (Illinois residents add 6% sales tax) to the address below. (Allow 20 days for personal checks to clear.) Credit card buyers may call our toll-free number below.

You can also order the more expensive hospital unit that averages 16 beats and has all the features including the small size of the previous unit. It costs **\$169.95**.

We'll send your Pulsetach pulse meter complete with 90-day limited warranty and instructions which include information on determining your Target Zone, Cardiac Recovery Time and other helpful information.

Then after your test, if you're not fully convinced that the Pulsetach is the best unit of its kind, the most convenient, and the greatest value, return it within 30 days for a prompt and courteous refund including the \$2.50 charge for postage and handling. You can't lose.

Your Pulsetach is totally solid-state so service should never be required, but if it is, the manufacturer has a national service-by-mail facility backing each unit. JS&A is America's largest single source of space-age products—further assurance that your Pulsetach is backed by a substantial company.

We've waited an awful long time to jump into the pulse monitoring field. But what a great entry. Order your Pulsetach at no obligation today.

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THAT THINK®

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sional photographers will critique your work and stimulate your photographic senses. You'll even have the opportunity to win photographic competitions.

For a complete packet of free information, call toll-free, **operator #203 at 800-648-5600** (in Nevada call 800-992-5710), or mail this coupon to McGraw-Hill Photography Workshop, 3939 Wisconsin Avenue, N.W., Washington, D.C. 20016.



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3030-060

## PM LOOKS AT RAIN DISPERSER



Rain disperser, installed in place of gutters, turns rainwater runoff from roof into droplets and prevents erosion.

**D**eflect Away rain dispersers perform the same functions as gutters and leaders—but with little or no maintenance, since they don't trap leaves. We installed a 10-ft. section a year ago and found that water running off the roof turns to fine droplets as



Brackets should be screwed to a fascia board as low as possible. Aluminum strips snap into place in the brackets.



A late-fall spraying with a garden hose keeps the dispersers free of debris.

it hits the disperser. This eliminated dirt splashing onto nearby siding, as well as erosion or trenching in the ground below the eaves. Dispersers are not suited to houses where poor drainage causes water to leak through basement walls. The manufacturer is Klenatron Co. Inc., 20 Hayward St., Ipswich, Mass. 01938. A 5-ft. section with hardware costs about \$10 at hardware stores.—J.P.



# MAKE A CLEAN SWEEP OF SHOP-VAC® SAVINGS... AT K MART.

The Vacs that revolutionized heavy-duty cleaning are sale-priced now at K mart. With features like: • Double filtration system to pick up wet and dry material • Automatic shutoff to prevent overflow • Built-in drain • Powerful, heavy-duty .94-hp, 6-amp motor to power-clean workshop, basement, garage, car,

patio or home • Handy tool pouch to keep accessories with the vacuum cleaner • UL listed.

The Wet/Dry Shop Vac is available in two models: an eight-gallon dual deluxe with nine standard attachments (Model 600-14); and a five-gallon deluxe with five standard attachments (Model 600-07).

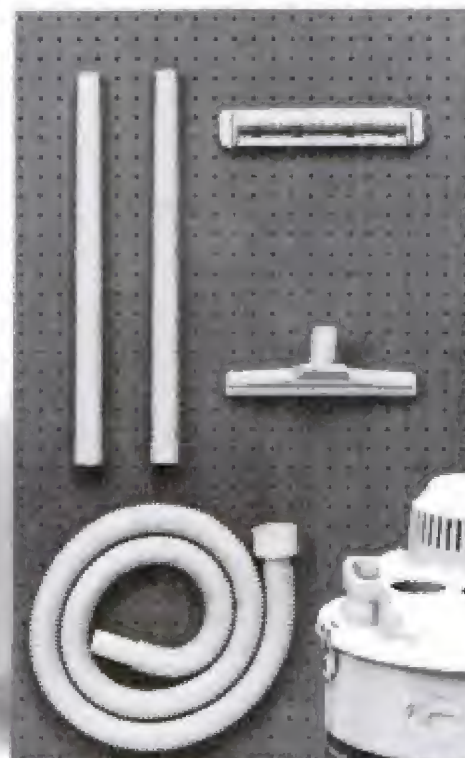
Both models include a four-wheel dolly with swivel casters for ease of maneuvering. On sale through June 28 at over 1,600 K mart stores across the U.S.A.



**\$39<sup>97</sup>**  
(Model 600-14)



**\$32<sup>97</sup>**  
(Model 600-07)



**Kmart®**

The Saving Place

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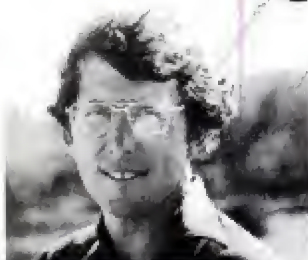
K mart Corporation

Troy, Michigan 48064



# 'What to do if you're teed off at athlete's foot.'

by Hale Irwin



"The only way I can keep my feet feeling up to par is to use Dr. Scholl's Solvex® Athlete's Foot Products."

When you feel the first itch of athlete's foot, just apply Dr. Scholl's Solvex Ointment or Spray. Solvex kills athlete's foot fungi on contact. And helps control the itching and burning of athlete's foot.

And, if you want to beat the itch before it starts, try regular applications of Dr. Scholl's Solvex Powder. It absorbs the moisture that athlete's foot thrives in and helps prevent reinfection.

"Face it, who knows more about feet than Dr. Scholl's? Their Solvex keeps my mind off my feet. And on the ball!"

**DrScholl's**



© 1979 Scholl, Inc.

## PM LOOKS AT PUMP-A-DRINK JUG



Plastic jugs with built-in pumps are available in ½- and 1-gal. sizes.

Large picnic jugs can be awkward to pour, especially on a picnic table crowded with goodies. You can leave this cold-beverage jug on the table and use your finger tips to dispense drinks. Press the pump top once or twice to fill an average-size glass.

The half-gallon jug costs \$14 and the one-gallon unit, \$17, at retail houseware outlets. They're from Aladdin Industries Inc., PM680, Box 100255, Nashville, Tenn. 37210.—H.W.



Pump mechanism is built into the jug lid. Unbreakable container keeps beverages cold, but isn't for hot drinks.



A gentle push on the lid top is all you need to pump liquid into the glass. Spout plug prevents spillage in transit.

## DON'T WAX YOUR CAR EVER AGAIN!

**Chemists Develop New Glaze To Save Your Paint**

A new discovery in the chemical industry *now makes car wax obsolete!* Wax, being soft, actually attracts and collects dirt — PROMOTING FADING AND PAINT ROT! CHEM-GLAZE is a unique, TEFLON® BASED POLYMER, SUPER HARD CURING RESIN SYSTEM, that will last up to 10 times longer than wax! By simply wiping on, CHEM-GLAZE will easily flow into paint pores, and completely seal paint against the destroying elements of the atmosphere.

Until now, CHEM-GLAZE has been used strictly by foreign import dealers, to protect costly custom paint finishes. It is also used on the body shells of race cars to cut wind resistance, and to give that "super-glossy" appearance.

### WARNING!!!

CHEM-GLAZE — has been relabeled and sold for *household* CHEM-GLAZE — has been recycled and sold for less, using inferior silicones, or acrylics, posed as our costly POLYMER/TEFLON® BLEND

CHEM-GLAZE will actually stop and remove oxidation on a car that is not new. Also, extensive salt-spray tests in Florida prove that the CHEM-GLAZE laminating effect will put an impregnable "glaze" that will last 2-3 years on new paint! WE GUARANTEE CHEM-GLAZE to be fully tested 100% SAFE AND EFFECTIVE! If you find

after using CHEM-GLAZE, that anything we say about this revolutionary product is untrue, return unused portion FOR A FULL REFUND! (minus shipping charges)

Invest \$14.95 today, for a 16 oz. bottle of CHEM-GLAZE, enough to treat three cars. These pennies will make you dollars in maintaining, or reselling a big investment — YOUR CAR!

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- ☐ Please rush one 16 oz. bottle of CHEM-GLAZE @ 14.95 (plus 12 shipping and handling in U.S.A. — 17 Foreign)
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- ☐ Check or Money Order enclosed ☐ Charge my Credit Card
- ☐ BankAmericard/VISA ☐ MasterCard, Interbank No. \_\_\_\_\_

Credit Card No. \_\_\_\_\_ Exp. Date \_\_\_\_\_

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City/State/Zip \_\_\_\_\_



# We just called a halt to the horsepower race.

**At Chrysler, we don't want to sell you any more outboard than you really need. And the outboard you need may be less than what you think you need.**

Remember when the biggest engine you could get was 40 horsepower? And all you needed to win a boat race on that little lake back in Western New York state was a 25 horse motor? Or remember learning to waterski behind a 10 h.p.?

Something happened in outboard-ing since those golden summers years ago. It was the horsepower race. Every year, something bigger, something better. And, needless to say, more expensive. We stopped raising the ante at 140 horsepower. For the majority of single and dual engine

installations, we believe this is more than sufficient.

We recently worked with the manufacturer of a 17' semi-vee hull weighing 1175 pounds. While it was rated at 115 h.p., the Chrysler 75 moves this hull easily. It will tow a couple of skiers or carry a whole boatload of fishermen out to where they're biting.

Important to you is the fact that our 75 h.p. costs close to \$500 less than our 115.

**With most boat and motor combinations, you reach a point of diminishing returns on the horsepower scale.**

We ran our 75 in waterskiing acceleration tests against a Mercury 80. It was an even match, which left us wondering why someone would need 5 extra h.p.

In comparison runs between our 75 and a Mercury 90, the Merc won. It was 2 mph faster at the top end. The question you have to ask yourself is whether a 2 mph difference is worth having to pay for 15 extra horsepower and buying extra gasoline.

The Chrysler Marine line of 19 outboards—from 4 to 140 horse-

power—is hand-built in a small Hartford, Wisconsin plant that's been making outboards since 1944. We believe our range is adequate for most applications. If you must have more power, our stern-drives from 195 to 240 h.p. should suffice.

**Chrysler outboards are designed and built to be simple.**

Take off the engine cowl and you'll see what we mean. No expensive gimmicks to complicate or malfunction. Just good, solid engineering. Engineering that not all our competitors have. Forged crankshafts—not cast. Needle, roller and ball bearings, exclusively, in every power-head. And a CD ignition that is unsurpassed in the industry.

**A Chrysler outboard is the perfect mate for today's lighter, more fuel-efficient boats.**

Get together with your Chrysler Marine dealer and decide how much horsepower you really do need.

**See your Chrysler Marine dealer, soon. And call a halt to the horsepower race.**



**OUTBOARDS  
INBOARDS  
OUTDRIVES  
DIESELS**

QUALITY ENGINEERED BY THE  
NEW CHRYSLER CORPORATION







# It has economy written all over it.

The Volkswagen Pickup.

Probably one of the most economical pickups ever invented with a fuel-injected gas engine. And if you want even more economy there's a diesel option that delivers mileage no one can beat.

(It gets an EPA estimated **23** mpg, 32 mpg highway, estimated **39** mpg diesel and 48 mpg diesel highway. Use "estimated mpg" for comparisons. Your mileage may vary with weather, speed and trip length.

Actual highway mileage will probably be less.)

But the engine's not the only thing that's economical.

It has front-wheel drive for economical power transfer from the engine to the wheels.

And, the engine is transverse-mounted for more economical use of cab space for passengers and better forward visibility for the driver.

What's more, it has an independently operating electric fan to cool the engine more economically, too.

In the back, it has double-wall construction so that if something you carry in its six-foot steel bed makes a dent on the inside, nothing shows on the outside. But the most economical thing of all about the Volkswagen Pickup is the fact that it's still a Volkswagen.

**VOLKSWAGEN  
DOES IT  
AGAIN**





# SCIENCE WORLDWIDE

## Power from the Dead Sea

Israelis are drawing solar energy out of water from the Dead Sea and using it to run a 150-kilowatt power plant.

Israel's Minister of Energy, Yitzhak Modai, inaugurated the system recently with the prediction that energy harvested from the lifeless sea, the saltiest body of water in the world, might someday provide most of the electricity for the country.

The solar pond is a shallow, black-bottomed basin filled with sea water. The high salinity prevents convection; when the sun shines, heat builds up in the lowest levels of the pond where salt concentrations are highest. This hot water, close to the boiling point, runs through heat exchangers, which extract energy to run turbines.

## Deadly optical illusions

Why does the moon loom on the horizon, then seem to shrink as it rises? Why do pilots misjudge the distance of runways, sometimes with fatal results?

Dr. Stanley Roscoe, a psychologist at New Mexico State University, thinks the questions are related.

Roscoe's theory: When you gaze at the moon on the horizon, your eyes are focused at a distance, accommodating to faraway land or water features. For unknown reasons, this distance accommodation makes the moon look bigger. It also makes airports appear larger when pilots approach cities over water. Their eyes focus on faraway lights; runways



Shallow pond, shown before filling with Dead Sea water, collects heat near briny bottom.

appear closer than they are; there's a temptation to drop below a safe altitude.

On the other hand, when the eyes adjust to seeing nearby objects—a dirty windshield, for instance—runways appear small and distant. The danger: overshooting.

Roscoe's theories aren't universally accepted, but experiments tend to support his idea that cockpit viewing conditions affect pilots' distance judgments. He began studying cockpit optical illusions more than 30 years ago when he outfitted a Cessna with a periscope. Pilots using it consistently judged the field to be farther away than it was—because their eyes were accommodating to the screen 15 inches in front of them. A slight magnification applied to the periscope corrected the problem. The research has aided the design of television control systems for remote-piloted vehicles and smart bombs.

## Aspirin and heart attacks

A major clinical trial to find out whether aspirin can prevent heart attacks has produced discouraging results.

During the 3-year test, the National Heart, Lung and Blood Institute kept watch on more than 4500 persons who had already had a heart attack. Some subjects took a gram of aspirin a day; others in a control group took placebos.

Earlier clinical trials had raised optimism that the group taking aspirin would suffer fewer second heart attacks. But the regimen apparently didn't work: Not only were there about the same number of heart-attack deaths in the aspirin

and control groups, but those taking aspirin suffered more side effects, such as stomach bleeding.

## Superbubble in space

Scientists have discovered an immense bubble of superheated hydrogen material centered in the prominent summer constellation Cygnus, the Northern Cross.

Dr. Webster Cash of the University of Colorado and Dr. Philip Charles at the University of California, Berkeley, found the glowing gas blob in data from a NASA satellite, HEAO-1, that collected X-ray emissions from space.

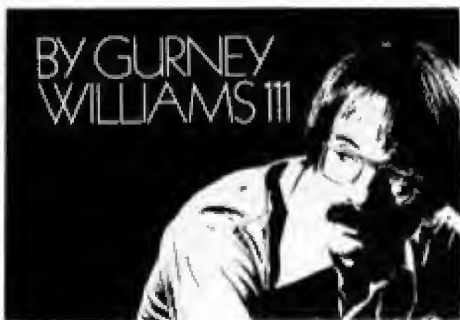
The bubble, some 6000 light years from Earth, is about 1200 light years in diameter, they said. Temperatures inside the bubble are about 3.5 million degrees F.

How did it get there? Cash suggests it began growing some three million years ago when a star exploded, battering a cloud of cool gas near Cygnus. The explosion compressed the gas, spawning other stars, which in turn exploded, blowing superheated hydrogen away from the cloud and into an expanding bubble. Our sun, Cash said, may have formed at the edge of a similar bubble.

FM



Periscope view (simulated here) made runways look too small. Result: overshooting.





# IMPORTS & MOTORSPORTS

## Future wagon



Volvo idea car uses turbo on the B-21, ohc Four to provide 30-mpg highway economy.

Volvo is long overdue with an update of its popular station wagon. Nice changes under the skin have been made over the years, but the old 140-series body is essentially the same as when introduced in the late '60s. Why, even the taillight lenses on the 1980 wagon are identical to those on the first 145 wagon of a dozen years ago! That's why it would be nice if the striking wagon shown here were a 1981 model. But, no, it is, as the sign says, a "concept car."

Volvo engineers were turned loose to design a wagon for the future and they started by reducing the drag coefficient: The nose was wedged, the rear was chopped and a chin spoiler was designed to minimize airflow under the car at 55-mph speeds. In fact, the spoiler automatically lowers at that speed; at rest and low speeds it is retracted, so it won't tangle with high curbs. The lowered beltline fell into place as a result of the change in body shape for improved aerodynamics. Other features of the car include new passive belt system, aluminum body parts, turbo on the B-21 Four, tailgate cut into the roofline for easier loading and onboard computer. Enthusiasm for the design at auto shows in Europe this summer could mean production early in the '80s.

## 1981 Saab sedan

Saab has concluded that not everyone wants a hatchback. Notchbacks do appeal to buyers who require that

their cars hold a trunkful of dignity. Four-door sedans like BMWs, Audis and Volvos give Saab its toughest competition here, and the Swedish automaker feels it better have its own sedan to go against the "up-scale imported segment of the market." The Saab 900 sedan will go on sale late this year as an '81 model. Like the hatchback, the sedan has a fold-down rear seat so you can have your dignity and versatility, too.

## Ford's wagon idea



Ghia Studio built this better idea for Ford.

There's a Ford Fiesta front-wheel drive train underneath, but you'd never guess it. The GTK is a station-wagon design from Ford's Ghia Studio in Turin, Italy. The miniwagon is built on a 94-inch wheelbase and fits four, plus luggage. Like the Volvo wagon, it's an idea car and not scheduled for production—yet.

## Another Honda model

Quint. What better name for a five-door hatchback? Honda does keep it simple, right down to the names it

pulls out of our dictionary for the cars it sells here. The nameplate is familiar in Japan, but the car is still not slated for shipment to the United States. The Quint is an all-new sporty sedan on a 93-inch wheelbase. It's 162 inches overall, 63.5 inches wide and 52.5 inches high. Fuel tank capacity is just over 13 gallons. Fuel mileage is reported to be 54 mpg at a steady 37.5 mph. Nice



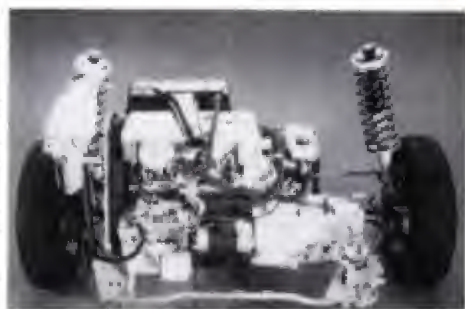
Honda Quint features 1601-cc CVCC Four.

economy, but it doesn't seem to be the kind of car you would want to drive that slow.

## More new diesels

The diesels keep coming. Latest addition to the list, the Volvo diesel-engine cars, went on sale here last month. The sedan and station wagon mount an in-line, six-cylinder diesel of 2386-cc displacement. The swirl-chamber design puts out 76 hp at 4800 rpm. Combined city/highway fuel mileage of these models is 28 mpg, 31 mpg for overdrive sedan.

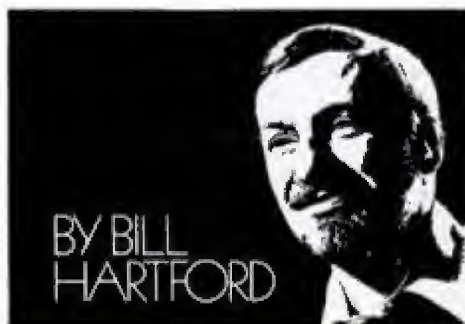
Also available now, but only in Europe, is the Strada diesel (the car's called Ritmo, or rhythm, in Europe). Fiat's diesel Four displaces 1714 cc, and we suspect it will be an optional engine in '81 Stradas. **FM**



Fiat diesel Four may become Strada option.



Sedan version of Saab 900 joins hatchbacks for the '81 model year.





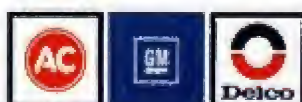


# DEFENSIVE LINES.

**AC Air and Oil Filters.** When you're talking about filters, the name of the game is defense. AC Oil Filters help trap damaging particles and clean your oil. AC Oil Filters also help provide many thousands of miles of engine protection. Air filters are part of the defense story, too. AC Air Filters are designed to include an oil-wetted paper element to promote dirt-holding capacity and to help remove dirt that can cause engine wear. AC Filters are recommended replacements for General Motors cars and light trucks and are available for most other American-built vehicles. So keep your guard up. Wherever you go for parts or service, ask for reliable AC Filters for your car's protection.

AC-Delco Division of General Motors Corporation.

## THANKS, AC.







**“My boys mow 11 lawns a week, not counting our own, so we really depend on our John Deere.”** Lucy Ellis, Dallas, Texas

Eleven lawns a week is a lot of mowing for one lawn mower.

Especially in Dallas, where the lawns are Texas-size and the mowing season runs from March through October.

Nevertheless, the Ellis family's 21-inch self-propelled John Deere has been doing the job for 2 years now, and it's still running as strong as ever.

“We've been real pleased with how dependable it is,” says Lucy Ellis. “It always starts right up, which our last mower didn't. And we've had almost no repairs to speak of.”

What's more, it's as easy to operate as it is reliable.

It has a powerful 4-hp engine that zips through tall grass with ease. A rear-wheel gear drive provides superior traction, even on hillsides.

And an optional 2½ bushel rear bagger allows for close-in trimming around trees, flower beds, etc.

John Deere 21-inch mowers come in a self-propelled model with an electric-start option and in a push-type model. Push models are also available in 18- and 20-inch cutting widths.

Come in for a demonstration soon.



For more information, write John Deere, Dept. 62, Moline, Illinois 61265.

**Nothing runs like a Deere®**





# APPLIANCE CLINIC

## QUESTIONS ANSWERED

### Leaky corner

*I have a Sears Kenmore dishwasher, Model No. 587-779400. Every so often it leaks from the front left corner of the machine. It does this for several days and then stops. What could be the cause?—R.L. Alderman, Bennington, Vt.*

First, you might look for a worn or loose door gasket. Check to make sure the gasket around the tub is snapped firmly into its mounting holes.

Pay special attention to the bottom left and right corners. Push the gasket so that it's tight against the tub. Remove any accumulation of food deposits at these corners with household vinegar.

If the gasket looks worn or flat, remove the two screws holding the door latch at the top of the tub. Remove a door shim behind the latch and reinstall it. Try the dishwasher and check it for leaks. Keep removing shims until the door is tightly sealed. If the door still leaks, the gasket should be replaced.

When the dishwasher is not being used, be sure to keep the door closed but not latched tightly. This will allow the gasket to breathe and swell to its normal size.

### Running marathon

*I have a General Electric refrigerator, Model No. TB304XB, which runs continuously, defrosting only when I manually defrost it. I replaced the thermostat and had a technician add more refrigerant gas to the system. It still continues to run. What can I do?—Edward Klein, Cedarhurst, N.Y.*

If the refrigerator still gets cold and your only problem is that it runs continuously, check the following items: the refrigerator clearance space, the condenser, the door gasket and the light switch.

Make sure the space on top of the refrigerator is at least 4 in. away from cabinets and is free of all clutter and storage items. Check the static condenser at the rear of the refrigerator to make sure it is clean and clear of any papers that may have fallen between it and the box.

Test the door gaskets by simply opening the doors and closing them on a piece of paper. There should be a slight tug on the paper as you try to pull it out. Test various spots along the doors by repositioning the paper. If the paper slips by itself or

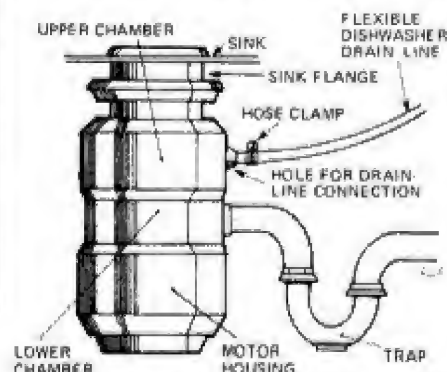
pulls easily, you should replace the door gaskets.

Next, open the doors and press the light switch in. The light should go out. If it doesn't, replace the switch.

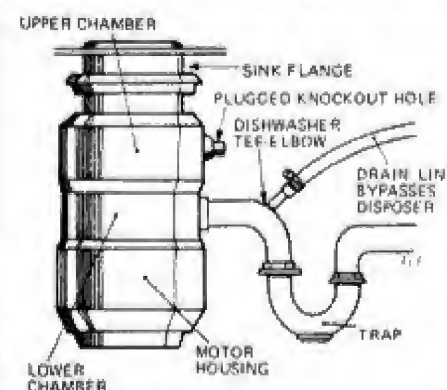
If all of the above check out okay, then the problem rests in the sealed system, probably the compressor. This diagnosis should be made by a qualified GE technician. At that time, you will be able to decide whether to repair or replace the refrigerator.

### Dishwasher vs. disposer

*Is it true that a garbage disposer shouldn't be used while you have the dishwasher running? If so, why?*



Dishwasher drain is connected to disposer through knockout hole in upper chamber.



To bypass disposer, plug knockout hole, connect drain to dishwasher tee-elbow.

*Would it be more efficient to attach the dishwasher to its own separate drain line?—Tim Pelzek, Milwaukee*

There is no reason why both units cannot be running at the same time as long as each has its own electrical circuits, so that you don't run the chance of blowing a fuse. The dishwasher uses only hot water. A cycle can last from 15 to 30 minutes or

more. A disposer is used with cold water and is run for only a few minutes.

The only caution I'd advise is to watch when you batch-feed the disposer—when you scrape and load the disposer full of food and then turn it on. Worn or dull shredding knives can force some food into the dishwasher drain-line connection when the dishwasher drains into the disposer (see top drawing, left). This causes a partial or full restriction, with the result that the dishwasher will not pump out or will pump out very slowly.

A separate drain line for the dishwasher (see lower drawing, left) is more efficient because the water bypasses the upper and lower chambers of the disposer and drains directly into the trap itself.

You can purchase the dishwasher tee-elbow connection at a plumbing-supply store. This system would eliminate any potential problems from a clogged dishwasher drain line.

### Knock, knock

*We purchased an Amana refrigerator, Model No. TR16W, in June, 1976. In the last three months, the refrigerator has developed a loud knocking noise when the compressor shuts off. The dealer says this is a common compressor problem and replacing it will do little good in stopping the noise. Is this true?—Margaret S. Cutter, Lima, Ohio*

Amana informs us that this is not a common problem with their refrigerator units. However, it is possible that a suspension spring in your refrigerator has either broken or slipped inside the compressor. This would cause the motor to lean to one side and knock loudly on start up and shut down, due to torque.

The only cure is to replace the compressor. Since this is a major job, have an authorized service agent confirm the problem before you have the job done.

You are still covered under the five-year, sealed-system warranty. So the only expense you will probably face for these repairs will be the labor cost.

PM

*If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. Problems of wide interest will be discussed in this column.*





# After 47,000 miles on gasohol—a clean engine

by Mort Schultz

**C**onfused by all the contradictory statements about the gasoline and ethanol mixture called gasohol? I was, too. So, I decided to find out for myself what, exactly, this fuel does to your engine.

I visited Buzz Marcus Toyota Co. in Glenside, Pa., because, up to now, probably no other outfit has operated cars more miles on gasohol than Marcus.

We disassembled an engine that had been driven since new on nothing but gasohol. In fact, it was operated most of these miles, not on the conventional mixture of 90 percent gasoline and 10 percent ethanol, but on an 80- to 20-percent blend.

The carburetor was like new. There was no dirt and no varnish, and metal and nonmetal parts showed no signs of corrosion. This is particularly interesting since the General Motors Research Laboratory in Warren, Mich., found that when testing gasohol in an engine on a laboratory test bench, some fuel system materials, notably elastomers, deteriorate more with gasohol than with gasoline.

When we pulled the head, there was no evidence of sludge or carbon buildup, although there was a thin layer of soot in the combustion chambers. The valves were clean.

Cylinder walls were shiny and so was the exhaust header. The only carbon present was on the tops of pistons. The amount was insignificant, and no more than would be present in an engine run 47,000 miles on gasoline and maintained properly.

I also removed the sparkplugs from another engine that had been running on gasohol for 15,000 miles. They were clean and showed practically no wear. The plugs on the 47,000-mile engine were changed every 15,000 miles; so when I saw them they had only a couple thousand miles on them.

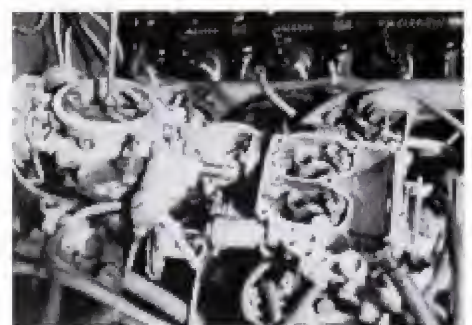
As far as I could see, gasohol is  
*(Please turn to page 36)*



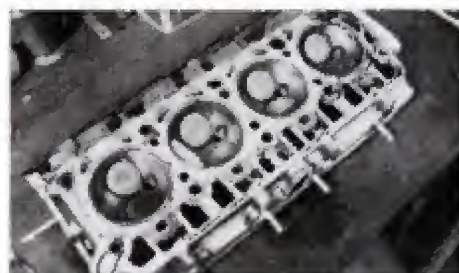
There are now only 2000 service stations in the country that are pumping gasohol. Due to certain government incentives, that number should double by sometime in 1981.



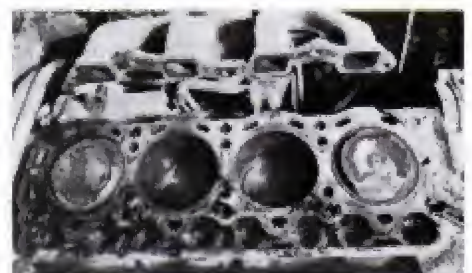
Changed every 15,000 miles on gasohol, the sparkplugs are free of carbon deposits.



The carburetor fuel bowl has no sludge after a total of 47,000 miles on gasohol.



Valves are clean and show little wear. Black deposit on combustion chamber is merely soot. Note wipe mark on No. 2 chamber.



The only carbon buildup occurred on the piston crown. But it was less than that found in engine run on straight gasoline.





KENTS  
DON'T  
HAVE  
IT!



MERITS  
DON'T  
HAVE  
IT!



MARLBORO  
LIGHTS  
DON'T  
HAVE IT!



WINSTON  
LIGHTS  
DON'T  
HAVE IT!



VANTAGE  
DOESN'T  
HAVE  
IT!



BENSON &  
HEDGES LIGHTS  
DON'T  
HAVE IT!

# Only Tareyton has the best filter!

For a taste too good to be 5.

Why the best?  
Because Tareyton's  
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means taste that's  
smooth. It means  
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It means that no other  
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Tareyton.



"We'd rather light than fight!"

## TAREYTON LIGHTS



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That Cigarette Smoking Is Dangerous to Your Health.

5 mg. "tar", 0.4 mg. nicotine av. per cigarette by FTC method.





**Ford wagons  
and the option  
that could  
pay for itself.**

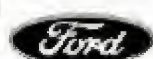
**A better  
protection idea  
from the  
Wagonmaster.**

**Just ask your  
Ford Dealer.**

When you order your new Ford wagon, be sure to consider the one option that could pay for itself. Ford Motor Company's Extended Service Plan. It's available to help protect you against rising service costs. And it's backed by Ford Motor Company and honored by participating Ford Dealers nationwide.

To learn more about what this plan covers and what it costs, see your Ford Dealer.

**The option that  
could pay for itself.**



**EXTENDED  
SERVICE  
PLAN**



Gasohol acts as a solvent and will dislodge dirt and rust from the fuel tank. Since this sludge can clog the fuel filter, check for it often to prevent stalling.

#### **A CLEAN ENGINE**

*(Continued from page 34)*

probably better for your engine than straight gasoline. Nevertheless, you may run into some problems when you make the switch. We'll discuss them later. First the good news.

#### **Higher octane**

The average octane quality of unleaded gasoline these days is 87. The average octane of ethanol is 98. When unleaded gasoline and ethanol are mixed at the 9-to-1 ratio to make gasohol, the average octane of the blend becomes 90. This is sufficient to eliminate pinging. If your engine timing is set correctly and you still experience some pinging, switching from straight gasoline to gasohol will probably cure it.

When you do switch to gasohol from gasoline you don't have to modify or adjust your engine at all. I've run my Pontiac V8 for several thousand miles on a 9-to-1 gasohol with no modifications. In fact, I tried a 20-percent mixture of gasoline and ethanol and had no difficulties.

Ethanol is an excellent motor fuel and very compatible with gasoline. It is made by fermenting and distilling crops such as corn, wheat, alfalfa and sugar cane. It differs from methanol, commonly referred to as wood alcohol, which comes mainly from natural gas and can be produced from coal.

Methanol cannot be used in present automobiles. For one thing, it is more corrosive than gasoline and ethanol-gasoline blends, and will quickly damage fuel tanks and carburetor parts. For another, methanol has less than twice the vapor pressure of gasoline. That means it doesn't vaporize very well

and tends to remain a liquid in engines. In testing methanol and methanol blends in engines, GM found that it created starting problems, poor warm-up performance, stalling and lack of acceleration. Such is not the case with ethanol. There are, however, other problems worth mentioning.

The water content in alcohol, for one, can give trouble, but I haven't experienced any. The alcohol in gasohol is 192 proof. Pure alcohol (no water) is 200 proof. Alcohol of 192 proof is 96 percent alcohol and four percent water, which isn't enough to cause a major problem. (To determine the percentage of water in alcohol, subtract the proof number from 200 and divide by two.)

However, some people are experiencing plugged fuel filters. The reason is that alcohol in gasohol may separate in cold weather and cause water to accumulate in the fuel tank. If a large quantity of water is pumped through the fuel line, the filter will clog. The alcohol in gasohol tends to act as a solvent. If there is dirt in the fuel tank or fuel line, alcohol may loosen particles and carry them through the fuel line to the fuel filter.

If you use gasohol and your engine becomes hard to start or begins stalling, the first thing to check is the filter.

Joseph Colucci, manager of the Fuels and Lubricants Dept. at GM Research Laboratories, cautions that you may experience other driving problems with gasohol, especially in models which do not have a closed-loop (feedback) fuel system. Some 1979 and many 1980 models possess this electronically controlled system.

"The oxygen in the fuel (ethanol is a partially oxidized hydrocarbon) causes vehicles to operate three percent leaner with gasohol than with gasoline," Colucci advises. "This leaner operation can increase problems such as surge, hesitation and stalls."

The ideal (stoichiometric) air/fuel ratio of gasoline is 14.5 to 1. That is, 14.5 parts of air for one part of gasoline. The ideal ratio for gasohol is 13.9 to 1. Therefore, when gasohol is run through your carb, which was designed for gasoline, the mixture will automatically be leaner than ideal for gasohol.

I haven't experienced any of these driving problems in the thousands of miles I've operated my car, which has a conventional fuel system, on 9-to-1 gasohol. But if I did, I would increase fuel/air mixture slightly.

Another potential problem you

*(Please turn to page 38)*



# Ford. The best gas mileage of any wagons built in America.

*But that's what you'd expect from the Wagonmaster.*

On January 5, 1929, Ford's first Woody rolled off the production line and onto the American Road. In that year Ford began a journey fifty years long, building more station wagons than anyone else, earning the right to be called Wagonmaster.

Today the Wagonmaster is also the Mileagemaster. 1980 Ford wagons have the highest mileage ratings of any wagons built in America. From roomy full-size LTD Wagons to versatile mid-size Fairmonts to value-packed

## BEST MILEAGE OF ANY WAGONS BUILT IN AMERICA.

WAGONS	EPA EST. MPG	EPA EST. HWY.	EST. RANGE	EST. HWY. RANGE
LTD (8-cyl.)	17	24	340	480
FAIRMONT (6-cyl.)	21	30	294	420
PINTO (4-cyl.)	23	38	322	532

Use these estimates for comparison. Your mileage may differ depending on speed, distance and weather. Actual highway mileage and range will probably be less than estimates. Calif. estimates lower. Comparison excludes diesels and other Ford Motor Co. wagons. Ranges are based on EPA mileage estimates and LTD's 20-gallon gas tank, Fairmont's and Pinto's 14-gallon gas tanks.

Pintos, Ford wagons are built to stretch your gas dollar.

And Ford wagons are the most popular of all. Since 1949, Ford has sold a million more wagons than anyone else\*.

When it comes to wagons, Ford's better ideas just keep getting better.

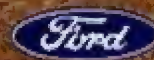
And that's what it takes to be the Wagonmaster.

\*Based on R. L. Polk & Co. registrations



FORD WAGONS

FORD DIVISION



# Wagonmaster - Mileagemaster. 1980 Ford.



# A WORK TRUCK NEEDS A WORK TIRE



## FIRESTONE STEELTEX RADIALS WORK.

Firestone Steeltex Radials for light trucks give you the long mileage, smooth ride, good traction and gas saving of a steel belted radial *plus* the hard nosed toughness of a real truck tire.

We built the Steeltex Radial to work. That's why the steel cord in Steeltex Radial belts is the same cord we use in the Firestone Transteel XR4s that roll on the 18 wheelers.

And that's why we build two of them. The regular Steeltex Radial and, for extra drive wheel traction, the Steeltex Radial Town & Country.



# Firestone

## STEELTEX RADIALS

### Working Tires For Working Trucks

Remember, the safety of any tire depends on wear, load, proper inflation and driving conditions.

#### A CLEAN ENGINE

(Continued from page 36)

may encounter is an increase in vapor pressure that occurs when running on gasohol. Generally, gasoline has a vapor pressure of 10 pounds per square inch (p.s.i.). The addition of ethanol raises the pressure to about 10.7 p.s.i.

This increased vapor pressure can cause vapor lock in hot weather. A vapor lock condition occurs when fuel boils in the fuel pump or fuel line. The resulting vapor blocks the flow of fuel to the carburetor, causing the engine to shut down until things cool off.

As a precaution, if you are going to operate a car on gasohol in hot weather, carry a Thermos of cold water. Cold water poured on a fuel pump and fuel line will relieve the vapor lock.

#### Mileage increase is small

As for the question of fuel economy with gasohol, if there is an increase, my experience has been that it's too insignificant to notice. However, Marcus Toyota claims that its gasohol-driven Toyotas get a 3.5-percent increase in fuel economy compared to a similar car using gasoline.

Furthermore, Illinois Bell Telephone conducted a six-month experiment, running 15 vehicles on gasohol and 15 comparable vehicles on gasoline. A company representative told me they showed an increase in mileage of 4.3 percent for the gasohol-fed cars.

Conversely, the Solar Electric Research Institute (SERI) says, "Most tests indicate that cars achieve more miles per B.T.U. with alcohol. However, since alcohol contains fewer B.T.U.s of energy per gallon than gasoline (110,000 for gasohol; 114,000 for gasoline), the mileage performance of gasohol does not differ significantly from that of gasoline, especially in new cars."

Colucci of GM agrees with SERI. He says, "With an open-loop (conventional carburetor) fuel system, fuel economy can either improve, decline or remain the same, depending on the carburetor calibration. With a closed-loop system, our data suggest that the fuel economy penalty for gasohol is about three percent."

Let me leave you with a word of caution: If you own a new car and get your hands on some 192+ proof alcohol, don't exceed the 9-to-1 gasoline-to-alcohol ratio. New car warranties cover vehicles that use gasohol containing only up to 10 percent ethanol.

FM





## We left our hearts in San Francisco ...and a case of Canadian Club.

San Francisco! What better place to hide a case of golden Canadian Club than the city where millions came to seek gold in the Gold Rush of 1849?

So, we boarded a cable car on our way to hide a case of the world's finest-tasting whisky in America's most beautiful city. Do you know San Francisco well enough to find the C.C.?

### A BART ride, a street with a past.

Start at BART's last city stop, and take a 30-cent ride. Change to another mode of transit, and ride until you can transfer again. Do so, and head for the farthest terminus, but debark at the first right-angle. Stroll a nearby street

till it suggests a profession. Then head back toward your latter mode of transportation one block closer to your former. Where idlers gather, note who stays longest.

### Find a way out of town but stay in.

Now head straight to some rails and follow them as far as necessary to meet a way named for an important Gold Rush figure. Let it lead you to a way out of the city, but don't leave. (If you've made it this far, don't think things are looking up.) Now return to the last route you were directed to. Somewhere along it we hid our Canadian Club. Things you've seen should tell you where.

### Tell the boss, "C.C., please."

When you reach it, tell the man in charge "C.C., please." You'll receive a case of Canadian Club, the world's finest-tasting whisky.

As you'll discover, C.C. is smoother and lighter than other whiskies. So try it on the rocks or in a sour or Manhattan. Millions know that Canadian Club is worth searching for. And 2,600 San Francisco Bay Area bars and restaurants know it's worth serving. So enjoy yourself. Say "C.C., please."



© 1980 • 6 YEARS OLD. IMPORTED IN BOTTLE FROM CANADA BY HIRAM WALKER IMPORTERS INC., DETROIT, MICH. 86.8 PROOF. BLENDED CANADIAN WHISKY.

**Canadian Club**  
"The Best In The House"®







"I ran out of Gillette TRAC II, so I tried another blade. The results weren't even close. I'll never run out of TRAC II again."

"If I buy bargain blades, I might get a shave I didn't bargain for. But I know I'll get a clean, smooth shave with Gillette TRAC II."

# To Guys Who Use Gillette TRAC II,<sup>®</sup> No Other Blade Will Do.



"No wonder I'm always sold out of Gillette TRAC II."

**Gillette**  
WE GIVE YOU THE EDGE.

© 1980 The Gillette Company

## HINTS FROM READERS

### Turnbutton stops drawers

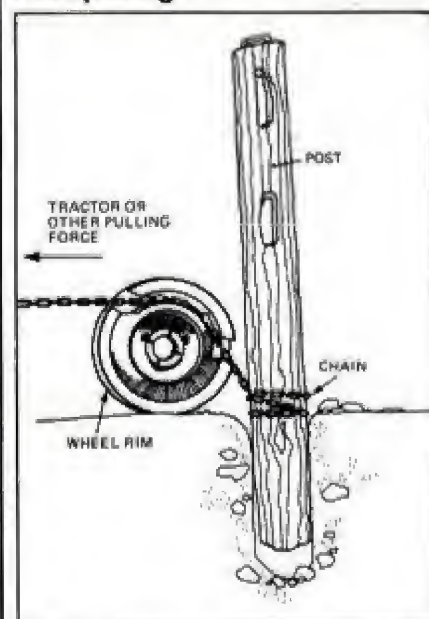


All too often, a shallow drawer is pulled completely out of its cabinet and its contents are scattered over the floor. To prevent this, I install a turnbutton on the top edge of the drawer back, as shown. When turned to the vertical position, the button strikes the case and the drawer cannot be pulled out.—*Howard Moody*

### Stop a swinging door

Stop a door from drifting open or shut by removing its top hinge pin and wrapping it with clear plastic tape. When it is replaced, the friction of a tight-fitting pin will generally keep the door stationary.—*Lane Olinghouse*

### Post pulling



You can easily pull up posts with a length of chain and a wheel rim. Wrap the chain around the base of the post. Then string it over the wheel rim and attach it to a pulling force, such as a tractor or car.—*Jim Wallace*





*The freezer. There's a Ford Granada in that block of ice - with Shell Fire & Ice motor oil in its crankcase. After we chopped through the ice, we turned the key. The engine started in four seconds.*



*The oven. Same test car, same Shell Fire & Ice, towing a 30-ton crane in the Mojave Desert 36 hours later. The oil temperature hit 270°F (well above normal). But Shell Fire & Ice protected the engine.*

## From the freezer to the oven in 36 hours: The Shell motor oil that had to earn its name.

Take a new Ford Granada and ask it to crank up fast, frozen in a huge block of ice. Then, after you've thawed it out, ask it to pull a 30-ton crane through several miles of Mojave Desert.

Do that and you aren't just asking the car to perform. You're demanding peak performance from its motor oil.

### **A frozen Ford gets a quick start**

Shell Fire & Ice® 10W-40 is an *all-season* motor oil. And an all-season motor oil should be able to help cold engines start fast.

Enter "the freezer."

First we built a special mold to hold our Ford Granada.

Then we put it in a gigantic freezer at zero degrees and sprayed in gallon after gallon of water. Layer by layer, the water was frozen around the car.

Inside the Ford's crankcase, the oil temperature dropped to well below freezing.

When we removed the walls of the mold, the ice was so solid that it took us an hour with two pickaxes to hack our way into the passenger compartment.

Finally, we turned the key.



Immediately, the engine cranked. In four seconds, it started. We'd gotten our Shell Fire & Ice All Season Motor Oil down to subfreezing, and it *still* helped the engine start fast.

### **"The Oven"**

An all-season oil also has to protect when the going gets hot. And the going that gets an oil the hottest is towing a heavy load.

So after we'd defrosted our test car (a 36-hour task), we hooked it up to the crane we'd used to lift the ice block out of its mold.

The crane weighed in at over 60,000 pounds—the Ford Granada, a mere 3,500 pounds.

We started towing. By the time we'd gone several miles, the oil temperature had hit 270°F. Well above normal.

Did Shell Fire & Ice protect? We tore the Ford's engine down the next day for a closer look. And after carefully examining its critical parts, our technical experts had the proof:

There was not one bit of abnormal engine wear. 36 hours after helping a cold engine start fast, the same Shell Fire & Ice Motor Oil had protected an extra hot engine.

### **Gas-saving formula.**

Shell Fire & Ice All Season Motor Oil is formulated to save gasoline. Your mileage will depend upon car and conditions.

So change to Shell Fire & Ice 10W-40 Motor Oil today.





# "Ten minutes in these rocks, but tough Stren® held him."



Jetty fisherman Harry Bode found out just how tough DuPont Stren® fishing line is.

"My plug was one foot from the rocks when a striper came out of the water and exploded on it," says Harry.

"I fought him in the rocks and on the rocks for ten minutes. I thought for sure he was going to wipe me out. I still landed him. There was nothing wrong with my line—25 pound-test Stren. That fish went a little over 30 pounds. It's hard to believe, but that stuff holds up."

Prove it to yourself. Fill your reels with Stren. And go get tough with a fish. Any fish.



**YOU NEED  
TOUGH STREN.**



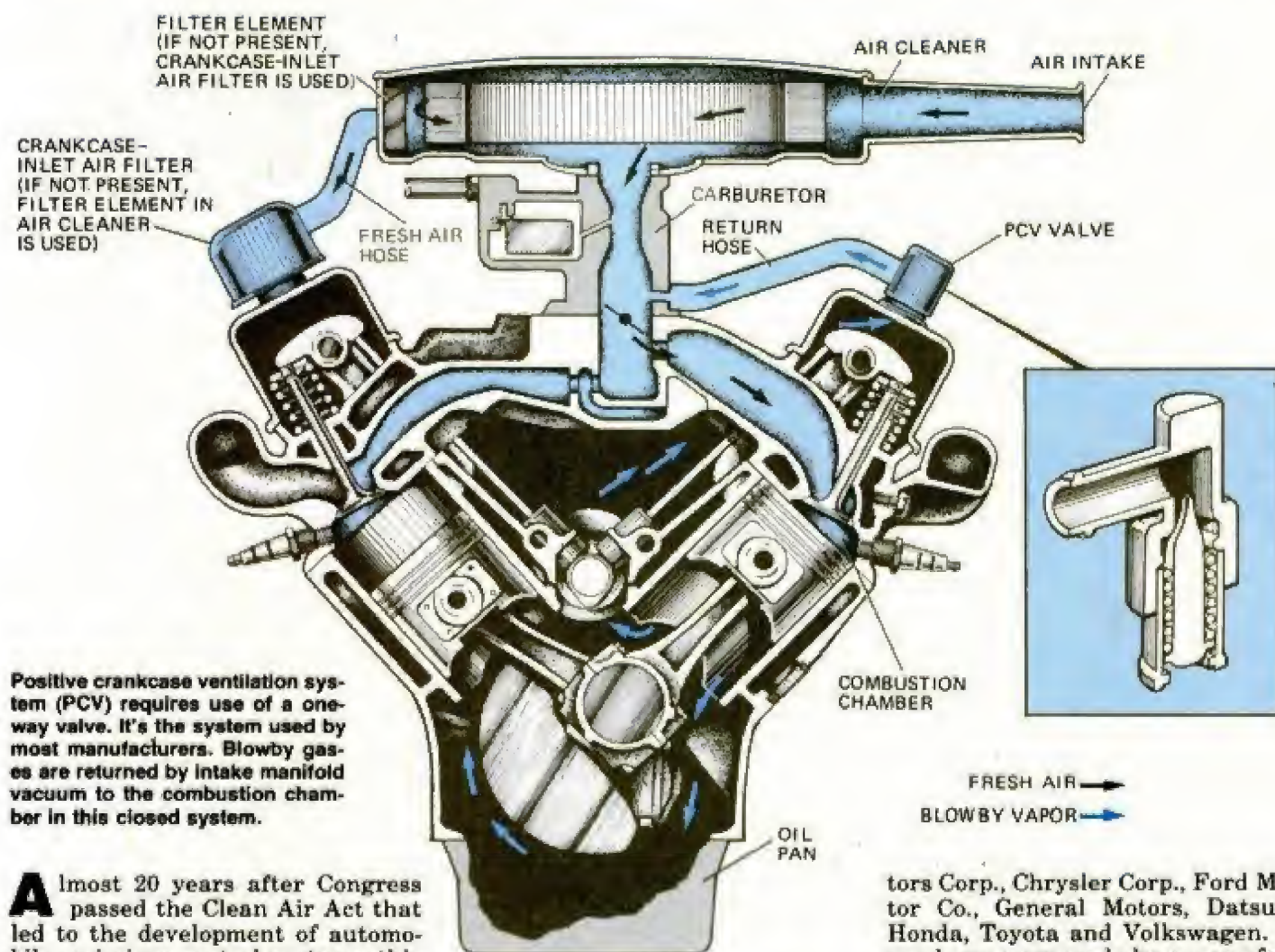
reenactmen

Manufactured by E. I. du Pont de Nemours and Company, Inc.



# Troubleshooting pollution-control systems

SATURDAY MECHANIC



Positive crankcase ventilation system (PCV) requires use of a one-way valve. It's the system used by most manufacturers. Blowby gases are returned by intake manifold vacuum to the combustion chamber in this closed system.

**A**lmost 20 years after Congress passed the Clean Air Act that led to the development of automobile emissions-control systems, this equipment still remains a mystery to many car owners. Consequently, emissions controls are blamed for a host of automobile problems they don't cause. On the other hand, they are rarely thought of as the source for many problems they *do* cause.

One reason for this confusion lies in the growing number of components. It started simply enough in 1963 with the crankcase ventilation system—a valve and a couple of hoses. However, in a 1980 Oldsmobile, for example, I counted over 50 pollution-control components. No wonder car owners are often confused about the exact functions of the various emissions systems.

Even more confusing is the fact that different manufacturers have adopted different methods of controlling the same pollutants. Differ-

ent methods have led to different hardware, calling for different service techniques.

However confusing the mass of emissions-control hardware seems, each piece fits into one of the only *three* systems. It is either part of the closed-crankcase ventilation system, the fuel-evaporation-emissions control system or exhaust-emissions control system.

This article discusses the closed-crankcase ventilation and fuel-evaporation-emissions control systems. Subsequent articles will deal with the exhaust-emissions control system.

We will concentrate on the systems employed by the eight leading manufacturers of automobiles sold in the United States: American Mo-

tors Corp., Chrysler Corp., Ford Motor Co., General Motors, Datsun, Honda, Toyota and Volkswagen. If you have a car made by a manufacturer other than one of these, your car uses a system similar to the emissions-control hardware used by one of the leading eight.

## PCV system

You can call it positive crankcase ventilation (PCV), crankcase-emissions-control system, crankcase-vapor-control system, or crankcase ventilation system. It is the oldest emissions-control system and has the job of preventing blowby gases (hydrocarbons), which get past pistons into the crankcase, from entering the atmosphere.

Blowby gases can't stay in the crankcase. For one thing, they would mix with oil and produce sludge. They could also produce acid. In any case, they would limit engine life.



Before the advent of crankcase-emissions control, blowby gases were blown out the crankcase into the air through a tube. Blowby was a primary cause of unhealthful air.

There are two variations of closed-crankcase ventilation systems used by the eight leading manufacturers. Six of them (Honda and Volkswagen excluded) use a system that employs a PCV valve to regulate the flow of blowby gases to the engine.

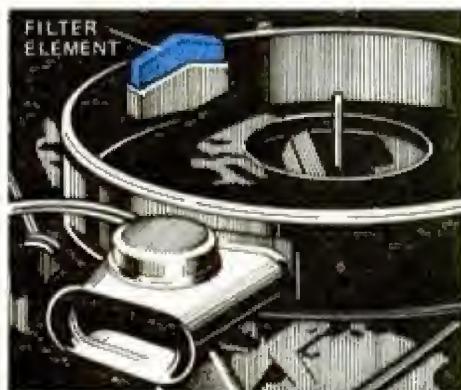
*Note:* Several models made by some of these manufacturers in the past have not used PCV valves, but have employed fixed orifices (see below).

Blowby gases escaping past pistons are drawn by intake manifold vacuum back up through the rocker-arm cover, where the PCV valve is normally located. They go through the PCV valve into the intake manifold, and into the cylinders where they are burned.

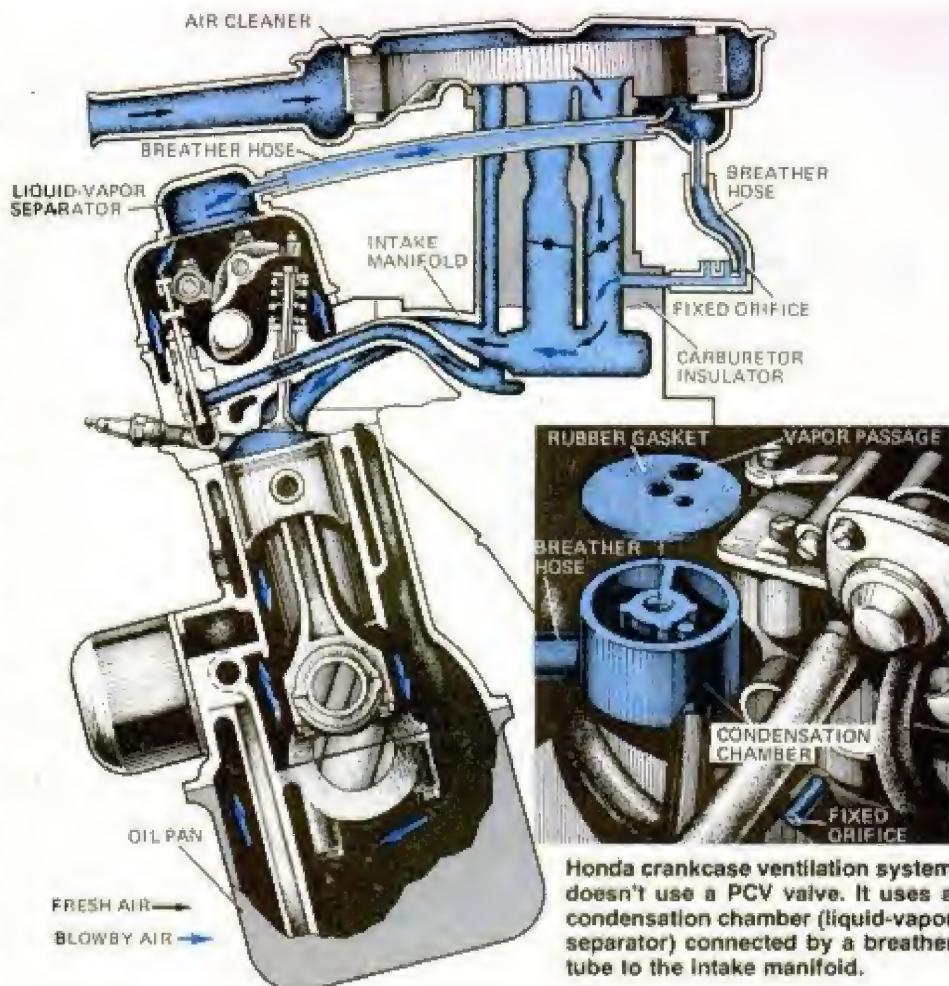
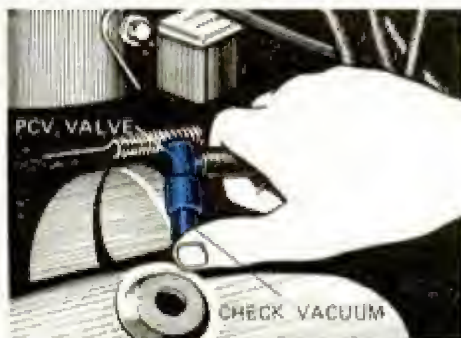
The systems used by Honda and VW divert blowby gases into the intake manifold through a fixed orifice in the base of the carburetor. The fixed orifice takes the place of the PCV valve. As you'll see below, the Honda closed-crankcase ventilation system is a little more elaborate than the VW system, and requires more maintenance.

### Blockage causes trouble

Whichever system you have on your car, it is subject to a buildup of sludge and other elements that can



The PCV filter element located in the air-cleaner casing cannot be serviced. It must be replaced with a new filter element. To test the PCV valve (below), remove it and check for vacuum with your thumb.



Honda crankcase ventilation system doesn't use a PCV valve. It uses a condensation chamber (liquid-vapor separator) connected by a breather tube to the intake manifold.

block the flow of blowby gases. After a period of time, the PCV valve, or the fixed orifice in particular, can get clogged badly enough to stop the flow of blowby gases entirely. This will affect engine performance. If allowed to continue, serious engine damage may result from the buildup of contamination and pressure.

An engine that has a clogged crankcase-ventilation system will demonstrate one or all of the following symptoms:

- Slow, unstable engine idle.
- Frequent stalling.
- Oil loss.

Pressure in the crankcase can blow oil up through rocker-arm covers and hoses into the carburetor air cleaner. A carburetor air-cleaner filter coated with oil is a sign that the PCV system needs servicing.

### Servicing the PCV system

To service a closed-crankcase ventilation system that has a PCV valve, follow these steps:

1. Pull the PCV valve from the rocker-arm cover while the engine is running. If the system is working, you will hear hissing as air passes through it. Shake the valve.

2. Place your finger over the valve inlet. You should feel strong suction. If not, the system has a blockage. Chances are the valve is clogged, so

replace it and test again. If there is still no suction, proceed with servicing.

3. Remove the hoses and check them for cracking. Replace hoses, if necessary. If hoses are okay, place them in a solvent, such as trichloroethylene, and let them soak for 10 minutes. Then, ram a clean cloth through them using a wooden dowel as a rod. Let hoses dry.

4. Examine the return-hose fitting at the carburetor. To remove deposits that may have accumulated, twist the shank end of a suitably sized drill bit in the opening. Be careful not to enlarge or deform the opening.

5. The system has either a crankcase-inlet air-cleaner filter on the rocker-arm cover, a crankcase ventilating filter on the side of the carburetor air cleaner, or a ventilating filter inside the air cleaner. Wash a crankcase-inlet air-cleaner or crankcase-ventilating filter in solvent. Let them air dry. Don't dry them with compressed air. You may damage the filtering element.

Replace a small filter in the carburetor air cleaner.

### Servicing the fixed orifice

To service the fixed-orifice system used by Honda, disconnect the breather hose from the carburetor



insulator and insert the shank end of an appropriately sized drill bit. Be careful not to enlarge or deform the opening.

Remove hoses and clean them in solvent, as explained above. Take the condensation chamber from the air cleaner. Remove the cover and inspect the vapor passage for a buildup of sludge. Clean out the vapor passage with solvent and a soft brush, if necessary.

Inspect the gasket. If it's damaged, replace it. Be sure the vapor-passage hole in the gasket is lined up with the vapor passage in the chamber. See that hose connections are tight.

To service the closed-crankcase ventilation system in the VW, clean hoses in a solvent. Clean deposits from them by shoving a wad of clean cloth through the hoses with a wooden dowel.

In 1976 a service notice was issued by Volkswagen which affected that model year's Rabbit crankcase ventilation system. As we mentioned, VWs don't use a PCV valve, but rather a restrictor with a 7-mm orifice. This system created hard starting and/or carb icing in cold weather by allowing moisture to collect in the intake manifold.

The service procedure outlined by VW included retrofitting a PCV valve and related plumbing to fix the problem. At the time, this was a "free fix" performed at all dealers. The fix is still in effect, but no longer free.

The installation requires two parts, a metal tube (part No. ZVP 202-851) and a PCV valve (part No. 211-129-101). It also requires the removal of the deflector in the air-intake elbow, and the removal of the restrictor in the valve cover to intake-elbow connecting hose.

If you find that your engine is

hard to start or icing occurs in cold weather, check out the crankcase-ventilation system. If the problem can't be cured by servicing the restrictor, then you'll probably have to retrofit the PCV system.

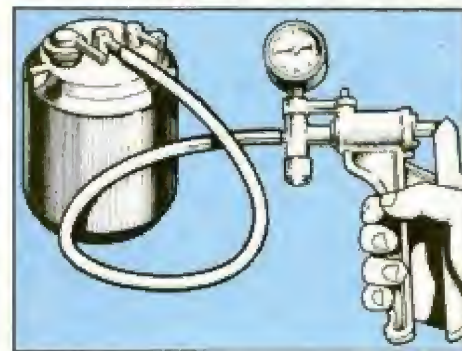
### Evaporation system

The fuel-evaporation emissions-control system, which was introduced in 1970-71, prevents the escape of gasoline fumes (hydrocarbons) into the atmosphere. The system is reliable and requires little service. However, if it doesn't receive this minimal service when it's needed, you will get a constant odor of gasoline.

A canister filled with carbon is at the heart of the system. Fuel vapor from the gas tank is stored in this canister until it can be diverted to the engine, where it is burned. Servicing the system normally entails servicing the carbon canister. There are two ways to do this: Replace the filter in the canister or replace the canister.

To replace the filter, remove the canister, turn it upside down and remove the filter (in the base of the canister). This should be done every 25,000 to 30,000 miles, unless the air in your area is particularly dusty. In that case, replace the filter more often.

To test the Honda charcoal canister, use a vacuum pump on the fuel-tank fitting. If vacuum is formed, replace the canister.



When you remove the canister, be sure to tag fuel hoses and their connecting points in some way, so hoses can be reconnected correctly. Incidentally, it is also a good idea to inspect hoses, which don't last forever. If a hose is cracked or dried out, replace it.

**Important:** Hoses used in this system are specially manufactured to withstand high concentrations of fuel vapors. When replacing a hose, be sure the replacement has the same markings as the old hose. Generally, hoses used in the fuel-evaporation emissions control systems are marked EVAP.

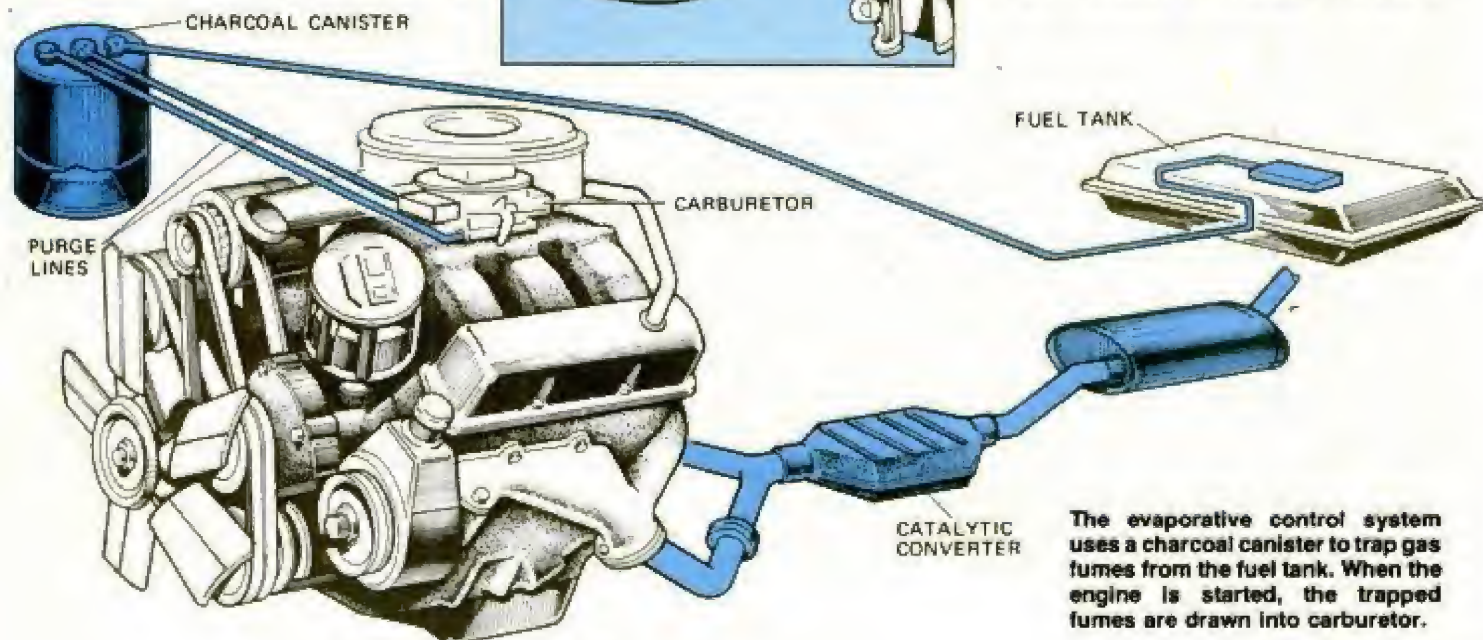
### More sophisticated systems

Beginning in 1979, some fuel-evaporation emissions-control systems became more sophisticated to further curtail the escape of fuel vapors into the atmosphere. Chrysler, for example, has added a fuel-vapor-return system to the fuel filter of all four- and eight-cylinder engines for sale nationwide, and to the fuel filter of all cars sold in California.

This system makes use of an additional line that runs from the top of the in-line fuel filter back to the fuel tank. There are, therefore, three lines emanating from the fuel filter, instead of two, as in most Chrysler products. You have the line coming from the fuel pump and the line going to the carburetor. That third line you may see on your filter is the vent line back to the fuel tank.

The purpose of this vent line is to return fuel vapors that form during idle and slow-speed operation to the fuel tank, rather than passing them to the carburetor where some may escape into the atmosphere.

The addition of this vent line doesn't necessarily mean that you must replace the fuel filter more often—unless, of course, you get a





load of dirty fuel that clogs the element. Normally, replacing the filter every 30,000 miles will suffice.

Ford Motor Co. models with 2150-2V, 2700VV and 7200VV carburetors have fuel-bowl vent valves as part of their fuel-vapor emissions-control system. The valve, located in the carburetor fuel-bowl-vent line, closes off the vent line when the engine is running to prevent vapors from escaping.

### An open valve is trouble

I mention this component for one reason. If you can't find the cause of a lean-fuel-mixture problem with one of these late-model carburetors, inspect this valve to make sure it is closing the vent line when the engine is running. If the valve remains in the open position, vacuum will affect air pressure in the carburetor, resulting in a lean fuel mixture.

Models 2700VV and 7200VV carburetors have an additional vent valve inside the fuel bowl. If this valve fails in the open position, it will result in a rich mixture that can affect engine performance.

Despite innovations such as these, probably the only servicing you will ever have to give the fuel-evaporation emissions-control system is to replace the canister filter, or the canister itself.

AMC, Chrysler, Datsun, Ford and GM use carbon canisters with replaceable filters. The only time it's necessary to replace the canister is if the canister cracks.

Honda, Toyota and Volkswagen use canisters which have to be replaced either periodically, or when tests show that they are clogged.

### Volkswagen Beetle

Replace the canister every 30,000 miles. The canister is located under one of the rear fenders (usually, the right rear fender). Make sure hoses are connected correctly.

### Volkswagen Rabbit

The following information *does not* apply to Rabbits with diesel engines.

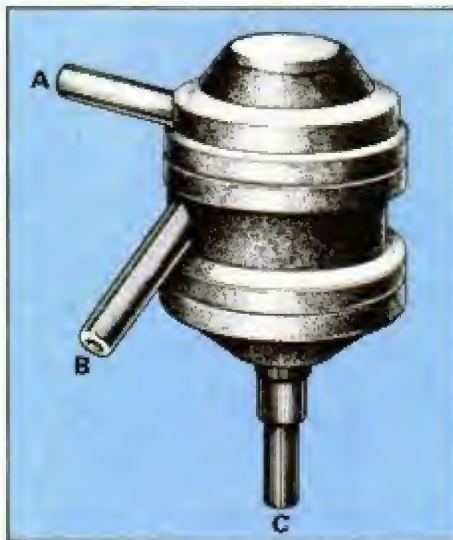
Replace the charcoal canister, which is in the engine compartment, every 30,000 miles. The system uses a fuel-tank-breather gravity valve, which must be operational to assure performance of the overall system.

The purpose of the fuel-tank-breather gravity valve is to duct fumes that escape from the fuel tank to the charcoal canister. If the car rolls during an accident, the breather gravity valve closes to keep gasoline from leaking.

The valve is located on the car body, to the right and above the fuel

tank. To test its operation, proceed as follows:

1. Remove the valve from the car.
2. Attach a hose to connection A and place the other end of the hose in a pan of water.
3. On 1977 and earlier models, plug connection B.
4. Holding the valve vertically, blow into connection C. If air bubbles don't appear in the water, replace the valve.
5. Keep blowing into connection C as you gradually tilt the valve. Bubbles should stop when the valve reaches a 45° angle. If not, replace the valve.



To test VW breather-gravity valve, attach hose to A and immerse in water. Plug B with finger and blow into C. If bubbles appear, the valve is faulty. To test a Toyota canister (right), plug B and blow through A. Air should flow freely through C.

Starting with the 1978 model Rabbits, a cutoff valve was installed between the activated charcoal-filter canister and the engine's air cleaner. The cutoff valve is supposed to remain closed while the engine isn't running, or running at idle. This prevents fuel vapors from entering the engine under those conditions and allows them to pass during wider throttle openings. In addition to trapping vapors, this valve also makes it unnecessary to disconnect the evaporative-emission-control hose from the air cleaner during adjustment of the idle mixture.

To check operation of the cutoff valve perform the following procedure:

1. Disconnect the cutoff valve at the air cleaner.
2. Blow air into the disconnected hose.
3. If the valve leaks or does not close completely when you blow into it, the valve is faulty and should be replaced.

### Toyota

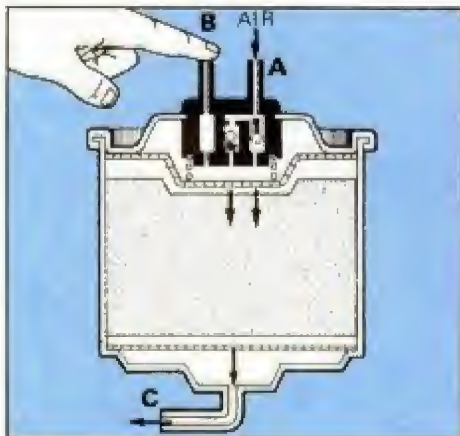
To determine if the charcoal canister has to be replaced, detach hoses from the canister. Be sure to identify them with their connections.

Hold your finger over connection B (see illustration) as you blow air through connection A. If the flow of air is restricted, or charcoal particles are expelled from connection C, replace the canister.

### Honda

To test the charcoal canister in a Honda, you should proceed as follows:

1. With the engine at normal operating temperature, connect a tachometer and remove the fuel-tank filler cap.
2. Remove the canister air hose from the connection on the car frame. The air hose is the hose protruding from the base of the canister. Connect a vacuum gauge to the end of the hose.
3. Run the engine at 3500 rpm. Vac-



uum should be recorded on the gauge within one minute. If it isn't, replace the canister. If vacuum appears, go to the next step.

4. Remove the canister from the car and attach a hand vacuum pump to the fuel-tank hose fitting. Pump the vacuum pump. There should be no vacuum. If there is, replace the canister.

If your car wasn't included in this section, it probably has a pollution-control system similar to one of those we did cover. To find out which system your car has, check your owner's manual first. If it isn't cited there, get under the hood and start tracing down the components. Start with the carburetor and trace all vacuum hoses to their components. Find the PCV valve and begin tracing the vacuum hoses from there. Do the same for the charcoal canister. You might make a rough sketch of the pollution devices and use the above information to figure out how they work.



19 mg. "tar", 1.3 mg. nicotine av. per cigarette, FTC Report MAY '78.

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**For big loads.** 1400-lbs. payload rating, 7-ft. box option.

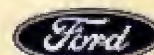
### OFFICIAL 1980 EPA RATINGS SHOW

	BEST MPG RATING		LONGEST RANGE	
	EPA EST.	HWY. EST.	EST. MILES	HWY. MILES
FORD COURIER	27	37	473	647
BETTER THAN TOYOTA	21	28	338	451
BETTER THAN DATSUN	25	32	423	541
BETTER THAN LUV	25	35	325	455

Use estimates for comparison. Your mileage and range may differ depending on speed, distance and weather. Actual hwy. mileage and range will probably be less than estimated. Fuel tank capacities (gal.) for LWB models. Courier 17.5, Toyota 16.1, Datsun 16.9, LUV 13.0. Calif. estimates lower.

# FORD

FORD DIVISION





# DETROIT LISTENING POST

## Two new nameplates

It's official: Ford's so-called world car, named the Erika in Europe, will bow here this fall as the Ford Escort and Mercury Lynx. There will be a three-door hatchback and five-door wagon, to be followed by a notchback sporty coupe in mid-'81 and a four-door sedan for '82.

At its Dearborn, Mich., facility Ford recently talked about the computer design, analysis and development that are going into its new front-wheel-drive world car. Then engineers showed off the engine plant that's been completely revamped and enlarged to build Escort/Lynx engines at a maximum rate of 225 an hour.

Ford is claiming its 1.3- and 1.6-liter engines for the cars will give better fuel economy and better performance than VW's 1.5-liter gasoline

ably buy four-cylinder diesels from its own Japanese partner, Toyo Kogyo (which also makes Mazda cars and trucks), for installation in the Escort/Lynx front-drivers by mid-'82.

Chrysler plans to deal for diesels with Peugeot of France, while American Motors will get its oil-burners from compatriot (and Peugeot's rival) Renault. All this overseas buying does not mean, however, that the Detroit makers aren't cooking up their own small diesels—it's just a good way to get into the market quickly, while the domestic diesel projects are getting underway.

## Ford tests PROCO

Ford has completed a trial production run of its 5.0-liter, V8 PROCO engine. The PROCO (for programmed combustion, a type of stratified charge) tested well, proving that mass-production of the fuel-efficient, gasoline-engine design is possible.

The chief concern about PROCO is the extremely fine production tolerances it requires, which could make it too difficult and expensive to build in volume.

PROCO is seen by Ford as an alternative to the diesel in future large and luxury cars, delivering comparable fuel economy without the traditional diesel drawbacks. The question of whether to go with PROCO engines or diesels in the company's mid-'80s smaller cars, however, is still to be decided by Ford executives.

## GM serious about electrics

Encouraged by recent advancements in battery technology, GM has moved its electric-vehicle development to front stage by creating a "project center" to coordinate it. "In making this move," says GM president E.M. Estes, "we are attaching the same importance to the design and engineering of a small, battery-powered passenger car that we are giving to GM's other passenger cars of the future."

While work on electric vans continues separately at the GMC Truck and Coach Div. in Pontiac, the Warren, Mich., GM Tech Center-based project group should have its first small electric commuter car designed so it can be in production by 1985.

## AMC "Eaglet" due this fall

Although it may be called something else, son of Eagle (internally called "Eaglet") is nearly ready for introduction this fall.

Sharp-eyed observers have spotted prototypes zipping around on road tests that look just as expected: high-ground-clearance Spirit sedans and coupes with Eagle-like fender flares and rocker skirts.

Nobody's talking details, but AMC chairman Gerry Meyers told me recently that the small four-wheel-drive car is aimed at "an entirely different market" from that of the family-oriented Eagle. In other words, it'll be a more youthful, sporty and fun vehicle, not to mention less expensive and more fuel thrifty. It will have a 2.5 liter, four-cylinder engine, manual transmission and part-time 4wd in base form. Meanwhile, Eagle itself will be offered in slightly more economical versions for '81, with at least two, and maybe all, of the above options.

## Short notes

■ Complaining about new-car prices? The Automotive Information Council reports that the average new car today costs only 36 percent of the median family income vs. 38 percent in 1970, more than 50 percent in 1960 and 70 percent in 1950. You never had it so good.

■ Having lost their Japanese-built, L-body, sports-car project to the cost-cutter's knife, GM's Buick and Oldsmobile Divs. are now scheduled to get their own coupe and sedan versions of the front-drive J-cars about a year after they debut in Chevy and Pontiac showrooms.

■ Dodge Division's '81 front-drive K-car will be called "Aries" when it replaces the Aspen compact line this fall. No word on names for the Plymouth or later Chrysler versions. **PM**



Computer-graphics model of Ford's Escort/Lynx is used to test its body rigidity.

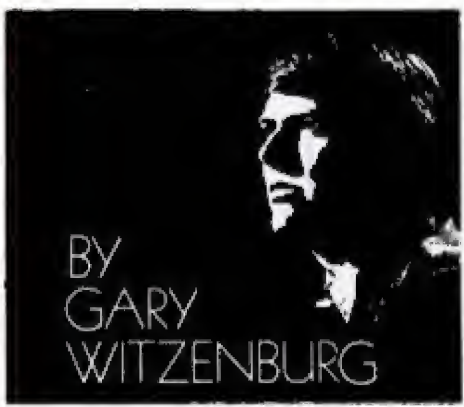
engine in the Rabbit. That'll be something, since the Rabbit engine is recognized throughout the industry for its excellent performance and fuel-economy characteristics.

## Small-car diesels coming

Chevrolet's Chevette will get two important additions to its option list this fall—a four-cylinder diesel engine (supplied by GM's Japanese partner, Isuzu) and a five-speed manual transmission for both gasoline and diesel versions.

This same diesel engine (or a version of it designed for transverse front-drive installation) will be offered in the Chevy and Pontiac J-car subcompact, scheduled to replace Monza and Sunbird early next year.

Not to be outdone, Ford will prob-

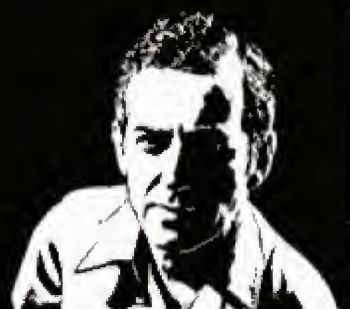




# CAR CLINIC

## SOLUTIONS FOR MECHANICAL HEADACHES

BY  
MORT SCHULTZ



### Paper rout

*My 1979 Pontiac LeMans Grand Safari station wagon has contact-paper sides—the wood-grain look. What I'd like to know is how to care for it. I've seen the sides of some older wagons turn white. Some people I've spoken to tell me to wax the sides. Others say don't wax, just wash. I need the truth.—T.A. Martin Jr., Broussard, La.*

One truth is that the "contact paper" sides of your wagon aren't contact paper. They're vinyl. Since they are vinyl, treat them as you would a vinyl top. Apply wax to them whenever you wax the rest of the car. In between the waxing jobs, wash the vinyl sides as you would the metal exterior parts of the car. And that, according to Pontiac, is the whole truth.

### Marriage counseling

*Please help. This is a serious problem, because my husband wants to dump our car. But I love our 1978 Ford Fiesta and I'm bucking him. If the car stands idle for a week or longer, its clutch freezes. Whenever this happens, the car has to be towed to the dealer for servicing. We were told by Ford, "You can't allow the Fiesta to stand for longer than a week since the clutch will freeze. This is characteristic of this vehicle, and nothing can be done." Is Ford right?—Mrs. Veronica Casciotta, Crystal River, Fla.*

Yes and no. Yes, because if you let your Fiesta stand for a week or longer, then, as you've discovered, the clutch will freeze. No, because there is something you can do about it.

The problem occurs more frequently in hot, humid climates. For a reason that's too complicated to go into here, heat and humidity have an adverse reaction on clutch-disc material, which causes the disc to stick to the pressure plate. If the car is driven often, a buildup of "bonding material" won't take place.

On Oct. 2, 1979, Ford put a new clutch into use. It has been installed

in new Fiestas coming off the production line and has been distributed to dealers. A part number is not available as I write this, but the new clutch has yellow markings on its outer circumference.

Take the car back to your dealer and have the new clutch installed. It should be a freebie, because this problem was in your car since you bought it. The money you would have spent for the clutch can be used to buy your husband a present, so you can kiss and make up.

### Low down

*I've had a problem with my 1978 LeBaron since it was new. I've not been able to fill the gas tank more than ¾ full. I've had the car to two Chrysler dealers. One of them even replaced the gas tank and rollover valve, but no help. Any ideas?—S.E. Tennant, Addison, Pa.*

How do you know the gas tank isn't being filled? If you're going by the fuel gauge, then I've got the solution to your problem.

Low fuel-gauge readings have been a problem with 1977-78 LeBaron, Diplomat, Aspen and Volare models built between March 21, 1977, and April 18, 1978—except Aspen and Volare six-cylinder two-door coupe and four-door sedan mod-

els with 18-gallon fuel tanks. The problem is inadequate air venting and is corrected by adding a notch to the lower end of the fuel-tank-filler tube which extends into your tank. The procedure is described in service bulletin 14-15-78 (7/24/78). Since the filler tube must be removed from the tank for the notch to be cut, leave the job to your dealer; it's a free fix.

### Shivering Chevette

*My 1978 Chevrolet Chevette has a small, but annoying problem. After hitting a puddle of water, there is a loud vibrating noise and shudder under the hood. If I depress the clutch and accelerate the engine, the vibration increases, so this rules out a drive train problem. The vibration gradually diminishes, and everything is fine until I go through another puddle. I've squirted a garden hose up under the car with the engine idling, but can't recreate the vibration. What do you think?—Donovan E. Radford Jr., Pittsburgh.*

I think water is being splashed on the drive belt, causing it to slip. The alternate slipping and locking of the belt is producing the vibration.

Chevy admits that this has been a problem with the Chevette, but there doesn't seem to be a solution. A baffle plate has been tried, but the plate reduces air flow and may cause overheating. See that the belt is properly tensioned and is in good condition. This will minimize vibration.

### Bad diet

*On a recent trip to Canada in my diesel VW Rabbit, I was advised by two service-station operators, who also drive diesel trucks, that the best additive to diesel fuel is automatic transmission fluid (ATF). I was told to add a quart of ATF to 20 gallons of*

*(Please turn to page 52)*



### Tete-a-tete

Says Arnold D. Kastrup of Richfield, Ohio: "Ever run out of gasoline and go to a station where they give you a can of gas, but they don't have a funnel?"

Yes, Arnold. So what can I do?

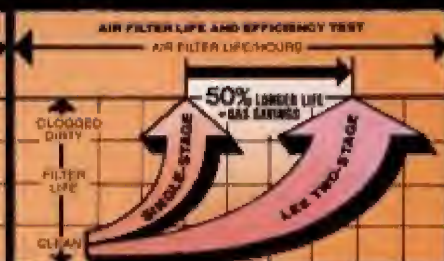
"Save one of those long-neck plastic bottles that you otherwise discard. Cut a window into its side and put it in the car. Now, the next time your engine runs dry, instead of being left up the creek without a funnel, stick the neck of the bottle into the tank filler, hold the bottle with one hand and pour with the other."

Thanks, Arnold. Good idea for an emergency.



# Try running with your hand over your nose and your mouth.

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## LEE MAXIFILTERS

NOW FOR IMPORTED CARS, TOO.



## CAR CLINIC

(Continued from page 50)

*fuel once every two or three months, or 3000 to 5000 miles, to clean the injectors. What problems, if any, will I encounter?—R.E. Hommel, Annapolis, Md.*

According to Robert Bosch Inc., which makes the injection system for the VW Rabbit, any dirt inadvertently introduced into the system with ATF could plug up the minute passages of the injection pump. Furthermore, I was told, this might bring about a chemical reaction that could cause deterioration of the pump seals.

An engineer for Robert Bosch told me, "If the fuel system is clean and free of water, there is no need for any additive." However, diesel No. 1 fuel which has been stored at service stations for a period of time can build up water and contamination. In fact, fungus will grow in diesel fuel if it sits long enough.

It seems, then, that the only fluid to put into a diesel engine is diesel No. 1 fuel, but even here you can encounter trouble if you aren't careful. It's a good idea to patronize service stations that pump a lot of diesel fuel. This means those stations that

you know are busy, such as highway truck stops. Then you know that fuel hasn't been sitting in the station tanks too long.

### Break the smoking habit

*The letter from Charles LaDow of San Diego in the Feb. '80 Car Clinic*

*caught my eye. He was having a problem with his 1979 Oldsmobile diesel engine smoking during uphill acceleration. I had the same problem with my 1978 Olds Custom Cruiser diesel at 36,000 miles. I found a cure. Maybe it will help Charles and others:*

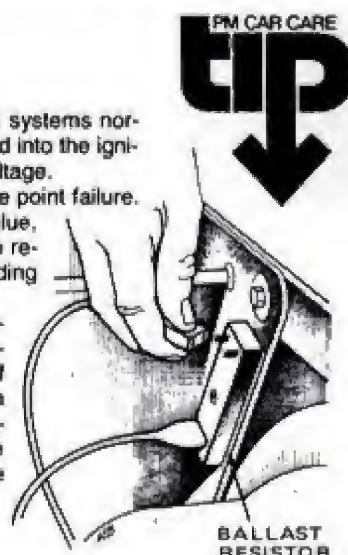
*Remove the air-breather filters*

### Resisting change

In case you've forgotten, cars with breaker-point ignition systems normally have a ballast resistor or a resistor wire incorporated into the ignition system to keep the points from getting maximum voltage.

Too many volts delivered to points will cause premature point failure. The resistor prevents this. But a resistor, if it changes value, can work in reverse. In other words, excessive resistance reduces the amount of voltage available to sparkplugs, leading to engine misfire, especially on acceleration.

A set of new plugs may eliminate the problem temporarily, but the condition will return when electrodes wear slightly and gap widens. So keep this tip in mind: If, for the life of you, you can't figure out why your engine is misfiring on acceleration, check the resistance value of the ballast resistor or resistor wire with an ohmmeter. Compare to the specified value allowed by the manufacturer. If it isn't the same, replace the resistor.



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(one on each valve cover) and wash them in a strong dishwasher soap and hot water. I do this at each oil change, and my car has stopped smoking. Warning: Do not use gasoline or any combustible solvent to clean air filters. Fumes are sucked directly into the air-intake manifold and could cause a problem.—Bill Kelso, Humboldt, Kan.

Simply superb advice, Bill. Thanks a million.

## Meeting her Waterloo

I made a mistake. I purchased my 1980 Pontiac Phoenix without power steering and I'm finding it difficult to park the car. My dealer is willing to install power steering for me if I can supply the kit. Can you tell me where it can be purchased?—Mrs. Anthony L. Mazzoli, Waterloo, N.Y.

Right from Pontiac, but I'm sorry to say your "mistake," as you call it, is going to cost you a bundle to rectify.

If your car is equipped with a heavy-duty suspension system, tell your dealer to order power-steering kit 7832592. If your car doesn't have heavy-duty suspension, tell your dealer to order power-steering kit 7833701.

The kit costs \$299. To this, you

have the dealer's charge for installation. It is not farfetched to assume that the total price will come to \$500.

## Service and safety tips

■ Chrysler Corp. has approved changes in the ignition timing from 12° BTDC to 8° BTDC to stop ping in federal (non-California) cars with 225-cu.-in. engines and two-barrel carburetors.

After making this adjustment, you should make sure that the carburetor speeds are set to the specifications on the vehicle emission label.

■ If you own one of the first 1980 VW Vanagons (built between July and Dec., 1979), you may have a problem. Improper torquing of the 10×16-mm ball-joint bolts may result in the bolts loosening. This could cause a ball joint to separate from the wishbone, leading to a loss of control.

The wise thing for you to do is to have the dealer check the bolt torque to make sure it is to specification.

■ If you're finding space too tight to get a new

## GOT A PROBLEM WITH YOUR CAR?

Just ask Mort about it. Send your question to the Car Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems that are of general interest will be published in the column.

oil filter into place on your 1977-80 Ford Courier with 2.3-liter engine, Ford suggests you use Motorcraft oil filter FL-300. It's stubby enough for you to fit it in place without the likelihood of banging your knuckles on the fender-apron flange.

■ More than 70 percent of the auto tires that are sold in the United States are of the whitewall variety and we're willing to bet that many car owners don't know how to clean them.

Goodyear says that the best way to clean whitewalls is to wet them and scrub with heavy-duty liquid detergent and a stiff brush. Then, rinse. An oil-based product may make whitewall tires look just like new, but it will also cause the rubber to deteriorate, so don't use it.

■ When changing the oil filter of a 1980 Chevrolet Citation with 2.8-liter V6 engine for the first time, don't take your cue from the PF-40 oil filter you find. The PF-40 is installed in production because of a clearance problem in the plant during assembly of the car. Once the car is in your hands and ready for a new filter, use a PF-51. This model offers increased capacity.

■ Hey, motorcyclists: A new eight-page tire information service bulletin showing step-by-step instructions for the demounting and mounting of cycle tires with tubes has been issued by the Rubber Manufacturers Assn. It's free and can be ordered from RMA, 1901 Pennsylvania Ave. NW, Washington, D.C. 20006.

PM



# NEW NOW for home and shop



**A** These regrindable taps have a series of gashes that replace the nose taper that's found on conventional taps. When the tap becomes worn, you can use the gashes as templates to produce new gashes behind the worn ones, and then cut off and discard the worn section. The new tap can thread 25 to 50 percent more holes between grinds than a conventional, cold-forming tap threads in its entire life, according to the manufacturer. Taps are available in machine screw sizes 0 (\$13) to 3/4-in. (\$31), in both NF (fine) and NC (coarse) threads, from Detroit Tap & Tool Co., 8615 East Eight Mile Rd., Warren, Mich. 48090.

**B** The Solid State Electronic Dishwasher has computerized controls that allow it to keep tabs on energy consumption. You select the wash, rinse and dry options depending on the amount of soil on the dishes and the time available. An LED readout displays the amount of energy consumed. The Model GSD2500, which costs about \$700, also diagnoses potential problems via its fault code on the panel. A manual tells what should be done to correct a problem. A digital display shows the number of minutes remaining until the end of the cycle in progress. The machine is due on the market around October 1980. It's from General Electric, 2100 Gardiner Lane, Louisville, Ky. 40205.

**C** Four new Carrier heat pumps are in the through-the-wall Sierra line. The Energy Efficiency Ratio for the units ranges up to 9.6. Cooling capacities range from 9500 to 17,700 B.T.U. Heating capacities in the heat-pump mode range from 8100 to 15,000 B.T.U., while in the electric-heat mode they run from 5000 to 16,000 B.T.U. Pumps have solid-state, variable-speed fans and ultrasonically bonded, all-aluminum coils. Units (from \$800) are by Carrier Air Conditioning, Box 4808, Carrier Parkway, Syracuse, N.Y. 13221.



**D** A new vinyl wall-covering kit introduced by Red Devil contains a paste and sizing brush, a wide smoothing brush, a razor knife and a seam roller. Detailed instructions for application of the wall covering are printed on the back of each package. The vinyl wall-covering kit is available at houseware and hardware stores and is priced at \$7. There's a separate kit that's been designed for working with other types of wall coverings. Both kits are made by Red Devil Inc., 2400 Vauxhall Rd., Union, N.J. 07083.





# Go ahead, make something out of it!

## Black & Decker is on sale at K mart.

Handy power tools at prices that are easy to handle. Now is the perfect time to add one or more of these popular tools to the worktable.

Circular Saw with 7 1/4" blade. Spring guard for safer operation. Adjustable guide for angle cuts. 3/4-hp Router for precision cutting and decorative edging. (Bits not included.) 1/2-hp Jigsaw. Variable speed allows

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These work- and timesaving tools are on sale through June 28 at over 1,600 K mart stores across the U.S.A.

**\$26.88**  
CIRCULAR SAW  
MODEL 7308

**\$23.88** ROUTER  
MODEL 7600

**\$23.88**  
DRILL  
MODEL 7190

**\$19.88**  
JIGSAW  
MODEL 7580

Black & Decker quality at a K mart price. Nice.

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Dupli-Color Auto-Spray® for your car is recognized as the finest automobile touch-up paint in the world. Dupli-Color Spray Enamels, Lacquers and Primers for the home give you that same assurance of quality and satisfaction.

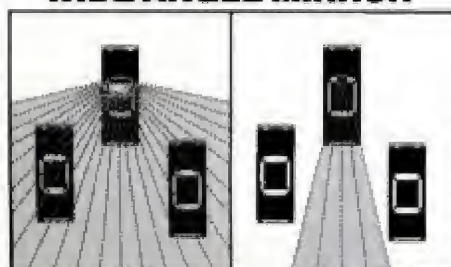
For a multitude of things in and around your home, you can't beat Dupli-Color Enamels, Lacquers and

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## PHOTO HINTS

### How dry I am



Clean, dry hands are necessary to make sure enlarging paper doesn't become contaminated in the darkroom. A hair dryer fastened to a gooseneck or other stand allows you to hold your hands in the airstream for drying. —Ken Patterson

### Thermometer holder



A clothespin will keep a thermometer from falling into a tall bottle when you take temperature readings. —Terry Huss

### Scratch hider

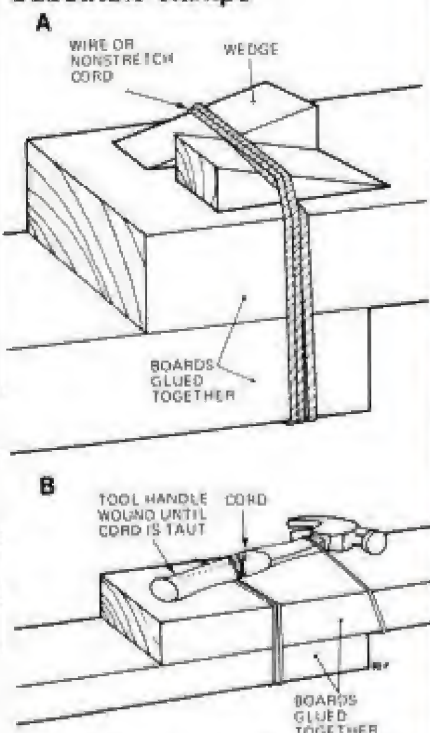


Tiny scratches on a negative are big lines on an enlargement. A tiny amount of petroleum jelly applied to the negative with your finger will fill the scratch and keep it from showing on the enlargement. —Bob Berger



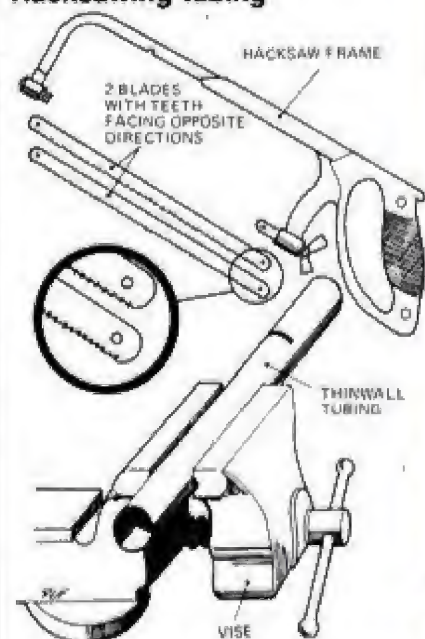
# HINTS FROM READERS

## Substitute clamps



If you don't have a C-clamp or vise, here are two ways to clamp work that's just been glued. Method A needs cord and two wedges. B uses cord and a hand tool.—*Theodore L. Gaillard Jr.*

## Hacksawing tubing



Use two saw blades to hacksaw thinwall tubing easily with less grab. Position the blades with their teeth facing in opposite directions.—*Howard Moody*



# Rain Dance<sup>®</sup> lasts longer than any other leading car wax.

Water beading proves it.  
DuPont guarantees it.

Rain Dance<sup>®</sup> is guaranteed to shine longer, to bead water longer, to last longer. It's the car wax with the watertight guarantee.

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**GUARANTEE:** "RAIN DANCE" is guaranteed to keep on beading and shining longer than the leading liquid or paste waxes. If not completely satisfied, return unused portion to 8-4233, DuPont Company, Wilmington, DE 19898, for full refund of actual purchase price and postage.



# ALL OUTDOORS

## Fixing afield

As if in answer to our recent complaints, a new on-the-go glue for outdoorsmen has just been put on the market, and it's worth tracking down at hardware and sporting-goods stores. It is called "Instant Crazy Glue for Fishermen, Hunters & Campers," and comes blister-packed in an .11-ounce plastic container, slightly larger than the little .07-ounce tube that seems to be on sale everywhere.

A number of these cyanoacrylates are available under a variety of brand names. They're the "miracle" glues that have tremendous bonding strength, but can be dangerous, if you're careless, since they will bond your fingers or eyelids together. (For eye trouble, wash only with water and see a doctor; fingers can be unstuck with acetone or nail polish remover.) We have tested an assortment of makes and all seem to perform equally well at home.

In the woods, it's been something else. Some tubes would get squashed in a pocket or leak in a tackle box, once they'd been opened, with disastrous results. Others can't be effectively recapped once they are opened, and may ooze during the pressure changes of an airline flight. The glues, with their rapid setting time and great strength, are ideal for fixing the broken tip-top of a fishing rod, resetting a splinter from a gun stock, securing a loose strap on a camera case, repairing the heel of a hiking shoe. But previously, the opening pin might break after one use, or the expensive little container wouldn't reseal and would have to be thrown away. Now Crazy Glue's Camper Model 815 has cured that with a pushpin that can travel successfully. A larger 20-gram supply is also available for \$7.98 from Crazy Glue, 53 West 23rd St., New York, N.Y. 10010.

These cyanoacrylates can cement mating pieces, but will not fill gaps satisfactorily, so it's still worthwhile to carry along a pair of moldable sticks of epoxy, as well. Consider small rolls of duct tape and strapping tape, needle-nose pliers and a couple of single-edge razor blades to round out your outdoor quick-repair kit. They can all help make a temporary fix until you have more time.

## Catching your world record

The next fish you hook may be the largest ever landed with the partic-

ular strength of line you're using. Even if it's not, it still could be bigger than any of that type that have been weighed in before. Either way, some new rules make it easier than ever for you and your fish to apply for fame and a spot in the record books.

The International Game Fish Assn. is now the record keeper for both fresh and saltwater fish. In order to update their categories of game fish, they are staging an international contest this year that will run through Nov. 30.

Explains Elwood K. Harry, noted president of the I.G.F.A., "In order that the anglers throughout the world will have a chance to show us, through their fishing activities, the amount and kind of species that should be considered for permanent world record status in our charts, we have made the decision to accept all applications without any charge to the angler.

"This new program will result in a set of freshwater world records that have been established under the same type of angling rules, and will have credibility comparable to our existing saltwater records."

Any fish, from a one-pound bluegill to a 1000-pound marlin, is eligible. The new equipment and angling regulations give all fishermen an even chance.

While you can get the rule book and record entry application forms at no charge from the International Game Fish Assn., 3000 East Las Olas Blvd., Fort Lauderdale, Fla. 33316, the best way to enter is to send in \$15 (tax deductible) and become a regular member. Then, along with the free forms, you get a free copy of their excellent *World Record Game Fishes* book with its complete listings and articles by famous fishermen (\$5.95 postpaid to nonmembers).

And in addition to a bimonthly newsletter, jacket patch, membership decals and card, you're supporting a worthwhile, nonprofit organization.

## Shooting to order

It's no secret that the safe and proper way to learn gun handling is to handle guns under proper supervision at a range. They are not always easy to find, and the answer can be a do-it-yourself group installation. Some recent case histories show it's not as hard as it sounds. You need a

place for a safe rifle and pistol setup, a number of interested people to do the organizing and the work, and money.

All, it turns out, are available in many communities. A new \$1 booklet from the National Shooting Sports Foundation, 1075 Post Road, Riverside, Conn. 06878, gives many of the answers or tells where they can be found.

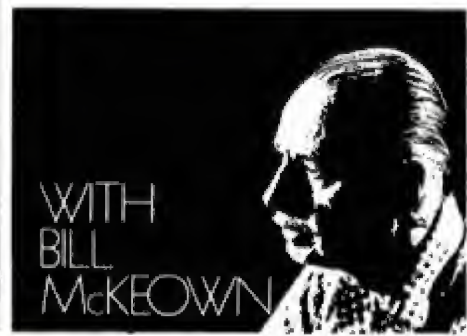
Called *How to Develop New Places to Shoot*, the publication outlines the sources for planning, organization, construction and cost guidelines, and the all-important financing. It turns out there are a number of industry and federal, state and local funding programs that are available for dedicated groups. This booklet provides names and addresses. A community that is anxious to have a worthwhile facility should find the answers here.

Two additional sources of guidelines for scattergun enthusiasts are the Amateur Trapshooting Assn., 601 West National Rd., Vandalia, Ohio 45377, and the National Skeet Shooting Assn. Box 28188, San Antonio, Tex. 78338. For shooting competition and training, trap and skeet fields are unrivaled, and are not difficult to set up. With the shotgun's limited range, much less acreage is required.

## Outdoor advisories

■ Want to build your own bicycle from scratch? *Designing and Building Your Own Frameset*, by R. P. Talbot, \$16.95 postpaid from the Magnet Guild, 310 Franklin St., Boston, Mass. 02110, will help to get you started.

■ Campsite reservations at 17 campgrounds in Yosemite, Sequoia-Kings Canyon, Grand Canyon, Rocky Mountain, Shenandoah, Great Smoky and Cape Hatteras National Parks can be made this year through 600 Ticketron offices, as well as by direct mail. **PM**





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**Enjoy our quality in moderation.**

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## FIRSTHAND REPORT

by Gary Witzenburg  
DETROIT AUTO EDITOR



# Driving the 1980 LeCar

Our newest naturalized citizen gets a bigger engine and better mpg.

**F**or 1980, LeCar benefits from several significant improvements. A larger, slightly torquier and, surprisingly, more economical 1.4-liter Four replaces the previous 1.3-liter Four; a new electronic ignition system improves performance and reduces maintenance costs; new damage-resistant fiberglass bumpers look better and save some weight compared to the old ones. In addition, there's an all-new instrument panel that looks much better than the previous bargain-basement design and features a more convenient control layout; larger side-window defogger vents have been added; and the combination of a larger

blower fan and more efficient air intakes provides much better interior ventilation and heating.

The 1980 LeCar, distinguished by a new set of rectangular headlamps, also boasts a number of small changes aimed at reducing noise and vibration. These include a quieter muffler; new rubber tailpipe mounts; reinforced engine and radiator mounts and air filter brackets; and sound insulation in the hood.

### Zip and comfort

The larger engine provides snappy performance and impressive EPA fuel economy numbers—30-mpg city (compared to 27 for 1979) and 40-mpg highway. AMC won't release horsepower figures, but we'd guess the new 1.4 puts out about 65 hp, compared to the old 1.3's 58 at 6000 rpm in U.S. trim. That doesn't

sound like much, but it's enough for (front) tire-spinning starts and plenty of useful zip for fighting the urban commuter wars.

LeCar provides a remarkably smooth and comfortable ride, even on bumpy roads, and with its agile handling, LeCar has a high fun-to-drive quotient. The low-back front bucket seats are "specially engineered by Renault's Bio-Mechanics Dept. to decrease driving fatigue and maximize driver and passenger comfort." While this language is straight from the press release, the claim happens to be true. Seats also lift and slide forward for easier access to the rear compartment. However, the standard-model buckets don't have a backrest angle adjustment.

Standard LeCar equipment in-

*(Please turn to page 62)*



What it lacks in power, LeCar compensates in crisp handling. Its unique suspension produces an extremely smooth ride.



Redesigned dash gives the car a more luxurious look. All of the switches have been repositioned to provide easier access.





Who says the Toyota 4-Wheel Drive Truck is leading the off-road pack? *OFF-ROAD* and *PICKUP, VAN & 4WD*! Both magazines named it "4WD of the Year" when introduced!

One reason is a 2.2 liter engine. It's bigger than any other small 4WD. That's extra power to move you out front, on the road or off. Our machine also has the highest running

ground clearance of any small 4WD, to help save you from getting hung up on the hard stuff.

The Toyota's high-riding good looks and fancy interior haven't hurt its popularity any, either. The Sport Truck model has locking front hubs, full carpeting, AM/FM Multiplex stereo radio and full instrumentation—standard. Tilt steering wheel and

power steering are available options.

Surprised that a new design could be so good so soon? Don't be. The Toyota 4-Wheel Drive Truck is the "Son of a Land Cruiser." We put our 30 years of experience building one of the world's toughest 4-wheel drive vehicles into it.

So get a Toyota 4-Wheel Drive Truck. And lead 'em, off the road.

**THE TOYOTA 4-WHEEL DRIVE TRUCK.  
IT'S LEADING EVERYONE  
OFF THE ROAD.**





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IT PULLS NAILS  
LIKE NOTHING YOU'VE  
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**SUPERBAR**  
Scrapes • Pries • Lifts • Pounds

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long for  
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three nail slots  
for convenience

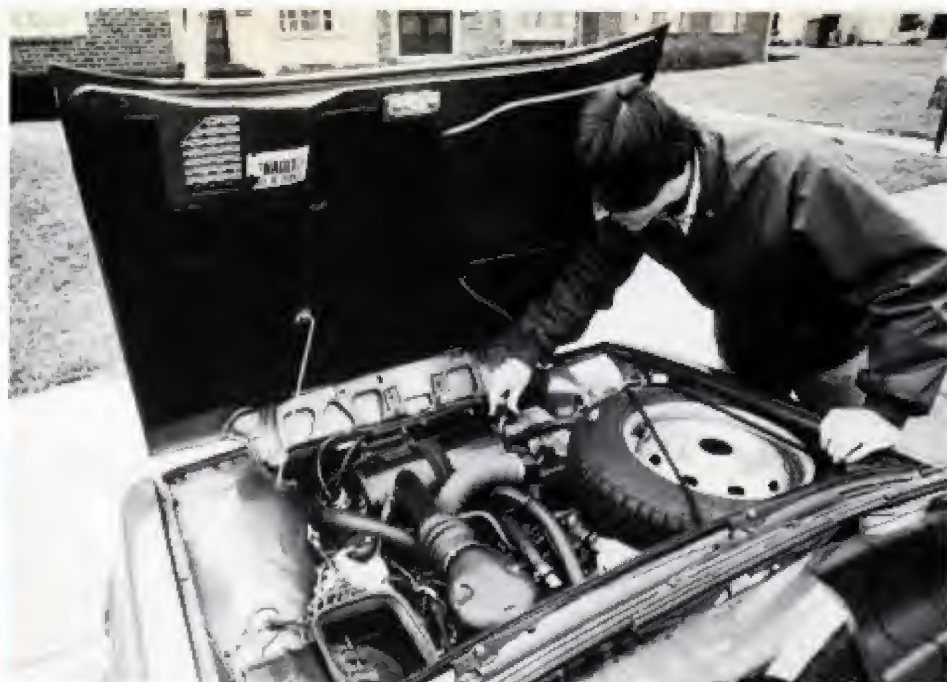
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Unlike most front-wheel-drive cars, LeCar's engine is positioned longitudinally. Once the spare is removed, access to the plugs, distributor and oil filter is easy.

### DRIVING THE 1980 LeCAR

(Continued from page 60)

cludes four-wheel independent suspension, with sway bars front and rear, front disc and rear drum brakes (balanced automatically by a load-sensitive proportioning valve), rack-and-pinion steering and Michelin steel-belted radial tires.

Although the wheelbase is long for the car's tiny overall dimensions (contributing to both ride and interior room), the turning circle is a very short 32 feet for easy parking and maneuvering in congested areas. There's no glove box, but nine pockets and bins of various sizes provide convenient storage space for most anything short of a picnic basket. The rear seat folds forward to more than triple LeCar's usable cargo room, and the rear hatch opens

down to bumper level for very easy loading and unloading.

With its manual choke, the little engine starts and drives away with ease on cold mornings, but there's no automatic shutoff and no temperature gauge to let you know when to shut it off. In fact, except for fuel and speedometer, there are no gauges—just "idiot" lights.

Considering LeCar's decade-old design, it's surprisingly contemporary and satisfying in most ways, and a good buy for the money at only \$4269 base. For \$600 more, the Deluxe version features reclining front buckets, power-assisted brakes, swing-out rear quarter windows, custom steering wheel, electric rear-window defroster, extra sound insulation, "rally" stripes and a removable rear cargo cover. Extra-cost options for the Deluxe include factory airconditioning, sunroof, rear window washer/wiper and clear metallic paint, but no automatic or five-speed manual transmission.

With more than two million LeCars on the road throughout the world, Renault seems to have it down right, because the car has achieved a first-rate reputation for durability and reliability. Every AMC dealer selling LeCars had to send his shop technicians through a special service training program.

LeCar should continue improving its popularity in fuel-conscious America. It has all the elements that made VW's Beetle so popular in the 1960s—controversial, but often endearing, looks and character, simplicity and outstanding fuel economy. Only this time, competition is a whole lot stiffer.

FM



With the rear seat folded, the cargo area provides 35.1 cu. ft. of luggage space.



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# AIR FORCE



# WHY MORE AND MORE PEOPLE WILL BE MOVING UP TO A NEW MIDDLEWEIGHT THEY CAN'T EVEN PRONOUNCE.

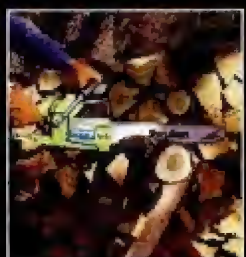
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are ready for a  
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CounterVibe is the one they'll be  
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bar and more.

And while it's got everything it  
takes to make cutting easier, it's also



The 3400 CounterVibe. Big enough to handle jobs most lightweights can't

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So there's less noise, less vibration,  
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Of course, with the Poulan 3400  
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harder time saying the name.

But you've never had an easier  
time cutting.



## The New Poulan 3400 CounterVibe.



Beaird-Poulan Division, Emerson Electric Co., Shreveport, Louisiana. Look in the Yellow Pages under "Saws" for your nearest Poulan Dealer.





## PM's Whatsit

What had 12 engines, a 157-foot wingspan, a 130-foot fuselage and flew 1370 miles nonstop 50 years ago? If you can't rattle off the name of this one of only three ever built, turn the page.

## If I only had a vane

Engineer Jim Lentell, an agricultural equipment designer in Chelmsford, England, is making a name for himself with his modern scarecrow apparatus. The "Gentlemen Jim" model, at Lentell's left in the photo, consists of a fairly convincing human head model, a red nylon tailed coat and paddle-type "hands" that cause the arms to wave in the slightest zephyr. The taller device, called a "Securicrop," is just a triangular steel box with wind-catching vanes that rotates in the breeze—but Lentell vouches for this one, too, as well as the smaller "Squarescare" aimed at the gardener market. An alternating bright-red-and-blue-stripe paint scheme, oscillating in the wind, is said to be the key to the vane-type devices.

For best results, says Lentell, always put bird-scare devices out *before* the birds attack a crop, and rotate them to a different location every five to six days.



## Time flies

In the opening segment of *Palmerstown*, a moderately acclaimed TV series based on *Roots* author Alex Haley's Tennessee boyhood, a mood-establishing shot of the old home clearly showed a jet contrail in the sky above. The setting was the 1930s.

## Gray power

Next to the brand-new McDonnell Douglas F-18A "Hornet" fighter in this photo, a World War II military aircraft complete with insignia, squadron markings and painted mascot (see page 96) seems a gaudy warbird indeed. The reason: This Hornet is the first of its type to appear in today's "operational" paint scheme, which consists of three shades of gray accented only with very muted national insignia (on fuselage directly under cockpit). Ap-



parently even in the modern air-to-air combat regime, dominated by radar target acquisition and missiles guided by infrared-seeking, or even more sophisticated electronics, a low visual profile still can give a fighter an edge.



Earlier developmental model of Hornet appearing in nonoperational orange and blue paint scheme gets off a Sidewinder missile.



# IPM BRIEFS

## Whatsit revealed

Before the Dornier DO-X rattled off into obscurity, it amazed a lot of people. The plane could carry up to 169 passengers, and those were 525-hp Siemens-Jupiter engines placed back to back (pusher and puller) on mounts that kept them high and dry above the wing. The plane was designed by Claude Dornier, head of the German firm bearing his name. The test pilot on the flight shown here, from Switzerland's Lake Constance, bore the appropriate Teutonic moniker of Richard Wagner.

## Magnetism and medicine still a gaussing game

Water for drinking and cooking in Russian hospitals is exposed to a magnetic field before use. Japanese authorities officially recognize magnetic devices as medical apparatus. Certain magnetic phenomena—such as the Hall effect (page 78)—still have theorists guessing as to their precise nature, but that has not kept "biomagnetism" from emerging as a prominent area of at least quasi-medical interest.

The marketing of devices such as the Magnetic Water Pencil (photo) is evidence of this interest. Consisting of no more than a cylindrical magnet a little more than an inch long encased in a ballpen-type plastic holder, the \$5.95 unit is intended to be used to "improve" the quality, taste—even the smell—of water "polarized" by stirring with the magnet. Our tests on New York City water (not that bad to begin with) yielded no noticeable results. Please do not send us your bad water for testing.



Aronson shows battery system; he stresses need for charging centers located in motels, shopping centers and service stations.

## The luxury electric

Shown with the first production model of his \$28,500 electric passenger car—dubbed the Transformer I—is developer Robert Aronson, president of Electric Fuel Propulsion Corp. of Troy, Mich. Aronson claims his company can produce 5000 cars per year and deliver within six months on special orders (the car shown was bought by actor Lloyd Bridges). Aronson also says he is lining up dealers and envisions a network of 100 recharging stations (which would be required to lease an \$8500 mobile recharging unit from the company) for the Southern California area.

Aronson says his 180-volt cobalt battery system delivers more than twice the power per unit weight as ordinary lead-

acid batteries, giving the car cruising speeds of 55 mph or better with a radius of 100 miles. With the mobile recharging unit, a 45-minute charge is good for another 100 miles—or, an emergency fast charge of 10 minutes' duration gives the car a 20-mile range. Owners could also get a full charge overnight through a built-in slow charger plugged into a 110- or 220-volt outlet. Aronson estimates the cobalt batteries will take 800 charges, providing up to 90,000 miles per system.

Accessories on the luxury model include stereo; power brakes, power steering and power windows. The air conditioner is battery-powered but the heater-defroster requires liquid fuel.





# 4x4 INTRODUCING THE DATSUN OF 4-WHEEL DRIVE



Grab your gear — the first 4x4s by Datsun are here! With the biggest choice of compact 4-wheel drive truck bodies in America.

**TOUGH IN THE ROUGH, SMOOTH ON THE ROAD**  
Datsun takes 4-wheel drive where the competition's never been. With the highest minimum ground clearance in the class. Solid steel plates to protect underbody parts. A powerful overhead cam engine. A separate high/low range 4x4 transfer stick. And enough built-in tough to tame the roughest road.

But there's plenty of beauty in the beast, too. The new Datsun 4x4s have independent front suspension and big 15-inch wheels to glide you in road-smoothing comfort.

**ROOMIEST COMPACT 4-WHEELER IN HISTORY**  
The Datsun King Cab 4x4 has over 7.1 cubic feet of inside storage space — and optional jump seats inside! Now check out the standards: reclining buckets, tachometer, trip odometer, flip-out rear side windows, flip-down cargo light and the only standard 5-speed in the class. No 4x4 can treat you more like a king!

And if you're looking for a long bed, Datsun's the longest in the class with over 7 feet of cargo length.

**REMINDER: BE GOOD TO YOUR LAND**  
Rugged as the new Datsun 4x4s are, it's important to respect the natural beauty of our wilderness land. Use 'em on the off-road roads, and in designated rec vehicle areas. That'll keep us all truckin' for a long time to come.

Visit your Datsun dealer, and test drive the hottest 4 wheels in America today — the 4x4s by Datsun!

## DATSUN WE ARE DRIVEN

Some items shown are owner-installed custom options.





# HOMEOWNERS' CLINIC

## QUESTIONS ANSWERED

### House too tight?

*My husband and I bought a 20-year-old, Cape Cod-style house. In the last five years, to help conserve energy, we've added insulation, storm windows and doors, and caulked the exterior. We now have black mold appearing on walls and ceilings and condensation on the windows. If we can't control it, we'll be replacing windows again, this time because they'll have rotted. We run two dehumidifiers in the basement in the summer. My washing machine in the basement drains into a French drain, which carries the water to a drain field.*

*My husband says the mold is due to the fact that our house is now too tight. If that's the case, why aren't some of the newer, insulated houses I've seen affected by the mold, too?—Danielle Bloomberg, Northampton, Pa.*

Mr. B is correct. Your house is now too tight. Before you did such a fine job of combating heat loss, cool, dry air could infiltrate under doors, windows and uncaulked gaps in the walls. This dryer air would offset the moisture in the air caused by normal, daily activities such as showers, baths and cooking.

You have to introduce cooler, dry air into your system and eliminate the moist air from your house. Start by getting rid of the French drain in the basement. Add exhaust fans in the kitchen and baths. Once a day, open a window slightly while you run these fans for 10 or 15 minutes. Also keep your dehumidifiers running in the winter. Opening the house will negate some of the good you've done conserving energy.

If you have a warm-air system, it is possible to duct fresh, outside air into your plenum. This should be dampered and connected to a humidistat to go on when your furnace motor starts. It is possible to pre-heat this air also, but if you do, you should consult a licensed mechanical engineer.

Another alternative is to run more dehumidifiers on the first floor. Read about the Airpliance in "Having and Eating Cake," on this page.

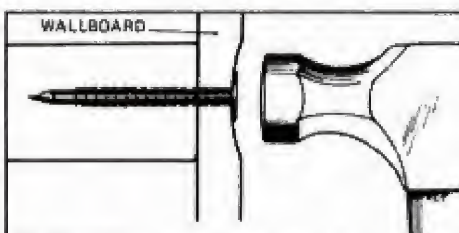
I doubt if the newer houses are tightened to the extent that yours is. Also consider lifestyle: Doors are constantly opened and closed in a house with children and pets. This seemingly short exposure to fresh,

dry air, when multiplied 20 times per day, adds up.

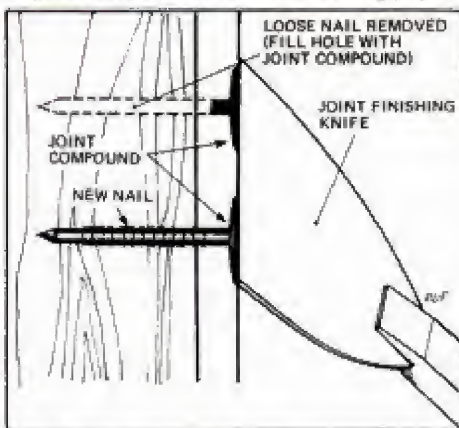
### Popped nails

*What's the best way to deal with popped nails that protrude or recede here and there on our modern drywalls? I've been a subscriber to Popular Mechanics for many years, but I don't recall a good answer to the question.—John Auer, Harvester, Mo.*

I'll just assume that your wife got the July '78 issue of PM before you



Last hammer blow sets nail and dimples adjacent wallboard without breaking paper.



Use a wide joint-finishing knife to apply three feathered layers of joint compound.

dry air and maybe left it at the garden club (See "Camouflaging nail dimples," *Homeowners' Clinic*, page 40). I'm also assuming that my answer was good. As nail popping is a common occurrence, the remedy is worth repeating, this time with the sketches (above).

Those popped nails are usually caused by shrinking of the framing members as wood dries, by settling, or by using an insufficient number of nails during initial installation. (Spacing should be one nail every 7

in.) If the nail is protruding from the surface, try removing it with your fingers. If it's tight, drive it back in. If it's loose, remove it, as vibrations will only cause it to show again. In either case, drive new nails about 2 in. on both sides of the faulty one. The last blow of the hammer should dimple the drywall and set the nail. Take care that the nailhead doesn't tear the outside paper of the drywall.

Follow the nail setting with three applications of joint compound using a 4-in. joint-finishing knife. Be certain that you sand lightly between coats.

### Having and eating cake

*We'd like to know of a system for providing combustion air to our fireplace. When we have a fire in our tight, energy-efficient house, air is drawn from our gas furnace, which is separated but in the same chimney as our fireplace. When we have a fire in the fireplace, flue gas is forced into the basement if either our hot-water heater or furnace is running.—Gordon B. Carson, Midland, Mich.*

Your problem is "kissin' kin" to "House Too Tight," the first letter on this page. The importance of supplying combustion air to fireplaces, furnaces and heaters is explained in a helpful pamphlet from the Minnesota Energy Agency, 980 American Center Building, East Kellogg Blvd., St. Paul, Minn. 55101. This illustrated, free booklet points out the dangers of not having enough combustion air.

There's an Airpliance Venting Kit made to supply heaters and fireplaces with combustion air. It's made by Basic Energy Conservation Services Inc., Dept. PM, 1296 Hudson Rd., St. Paul, Minn. 55106. The kit costs about \$80; it's easy to install. You may want to write the manufacturer in order to obtain a brochure. **PM**

*Do you have a home maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of wide interest will be discussed in this column. For more home repair and maintenance help, get PM's Home Care Guide, \$4.95 postpaid. Send order(s) to PM, Dept. HCG, Box 1014, New York, N.Y. 10019.*





*Premium. Imported.*



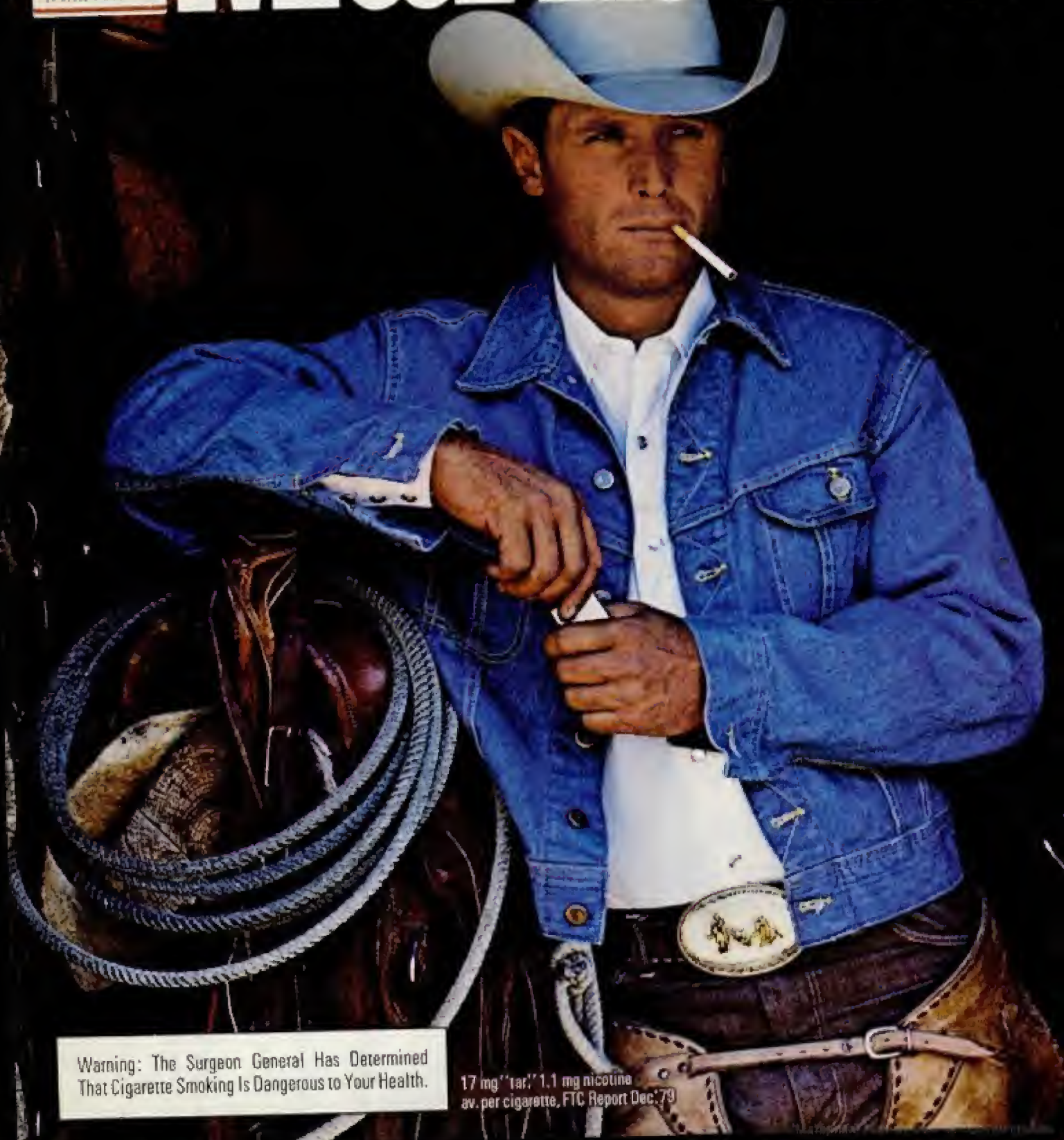
BLACK VELVET® BLENDED CANADIAN WHISKY, 80 PROOF. IMPORTED BY © 1979 HEUBLEIN, INC., HARTFORD, CONN.

# Velvet Touchin'.





# Marlboro



Warning: The Surgeon General Has Determined  
That Cigarette Smoking Is Dangerous to Your Health.

17 mg "tar," 1.1 mg nicotine  
av. per cigarette, FTC Report Dec. 79



# Rocket boat shoots for Mach .5

Can the former record-holder bring the world boat-speed record back to the United States?

by Steven Parker

**S**peed on the water is going to approach the speed of sound if Californian Lee Taylor has his rapid way this spring. His gleaming missile-shaped rocket ship, U.S. *Discovery II*, is scheduled to take a first shot at the world record on Lake Tahoe at about the time you read this article. Sixteen-thousand horses of power have been harnessed into the 40-foot, 2500-pound craft to push it faster than any boat has ever gone before, and bring the speed championship back to the United States.

The current record is held by Ken Warby of Australia. In 1978, using a turbojet-powered racer that was somewhat similar to an earlier Taylor speedster, Warby broke the previous record that Taylor had held for 11 years with a new clocking of 317.60 mph on the lake behind Blowering Dam, Australia. But Taylor believes his new boat can do more than up the record and is planning for 350 miles per hour plus an eventual try toward transonic speeds.

Lee Taylor may regain his title as the fastest man on water—or disaster may strike as it did at Lake Mead, Ariz., in 1964, in an

accident that left him in a coma for 18 days. Now, at 45, Taylor has everything riding on his *Discovery II*. Working out of a building in an industrial park in Irvine, Calif., Taylor and his small band of volunteers have been up late nights for the past three years constructing this vehicle that more resembles a fighter rocket out of *Star Wars* than any kind of boat. The results, however, have convinced Taylor, his crew and his major sponsors, Ducommun Metals and the Sahara Tahoe Corp., that his target speeds of 350 and beyond are more than possible.

*Discovery II*'s 40-foot hull is powered by a Woodruff rocket engine that is capable of 8000 pounds of thrust, approximately 16,000 incredible horsepower from a totally nonpolluting fuel of hydrogen peroxide. The working



Holding a model of his new U.S. *Discovery II*, Lee Taylor stands beside trophy he held 11 years, the prestigious Royal Motor Yacht Challenge Cup that goes to the world speed-record holder. Taylor has to top 317.6 mph to bring it back from Australia.

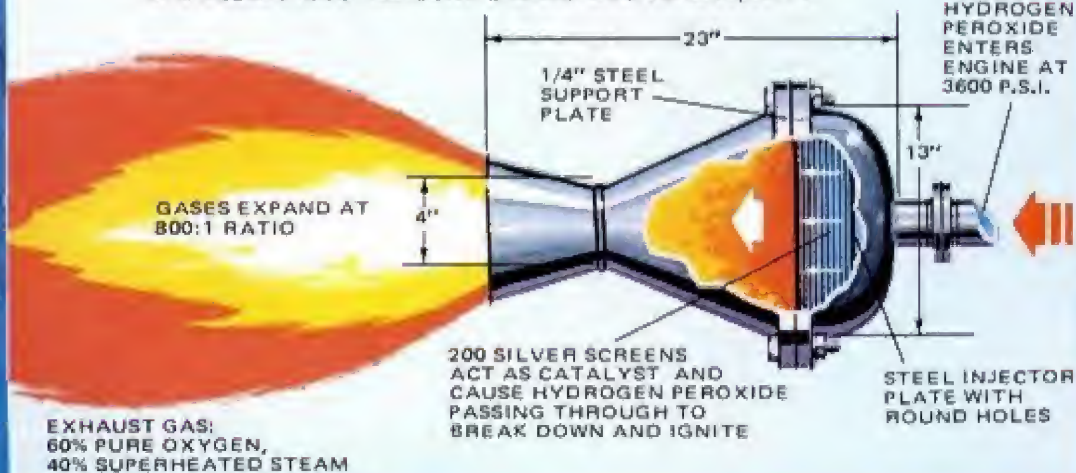


# Airborne at rocket speed,



U.S. Discovery II patented (No. 4,095,549) by Arthur L. Williams

## STAINLESS STEEL 150-POUND ENGINE: DELIVERS 16,000 HP



In the Woodruff engine, 200 12-inch-diameter circular silver-mesh screens, similar to window screens, fire off the hydrogen-peroxide fuel to develop the tremendous 8000 pounds of thrust. This "engine" inside its stainless-steel shell weighs only 26 pounds. Pilot's right-hand throttle controls the injection of the fuel/air mixture and its pressure.



# Discovery II aims for world record.

core of the 150-pound engine weighs a mere 28 pounds, and is one of the smallest and lightest components of the vehicle. If the engine is working correctly, the critical factor of the rocket boat's success depends on the air-pressure force feeding the hydrogen peroxide to the silver-mesh-catalyzing screens in the engine that create the propelling explosion. This is no back-yard exercise in speed. The U.S. *Discovery II* combines the latest in boat and aircraft design in both engine and hull.

The craft carries two 50-gallon stainless-steel fuel tanks, one mounted for-

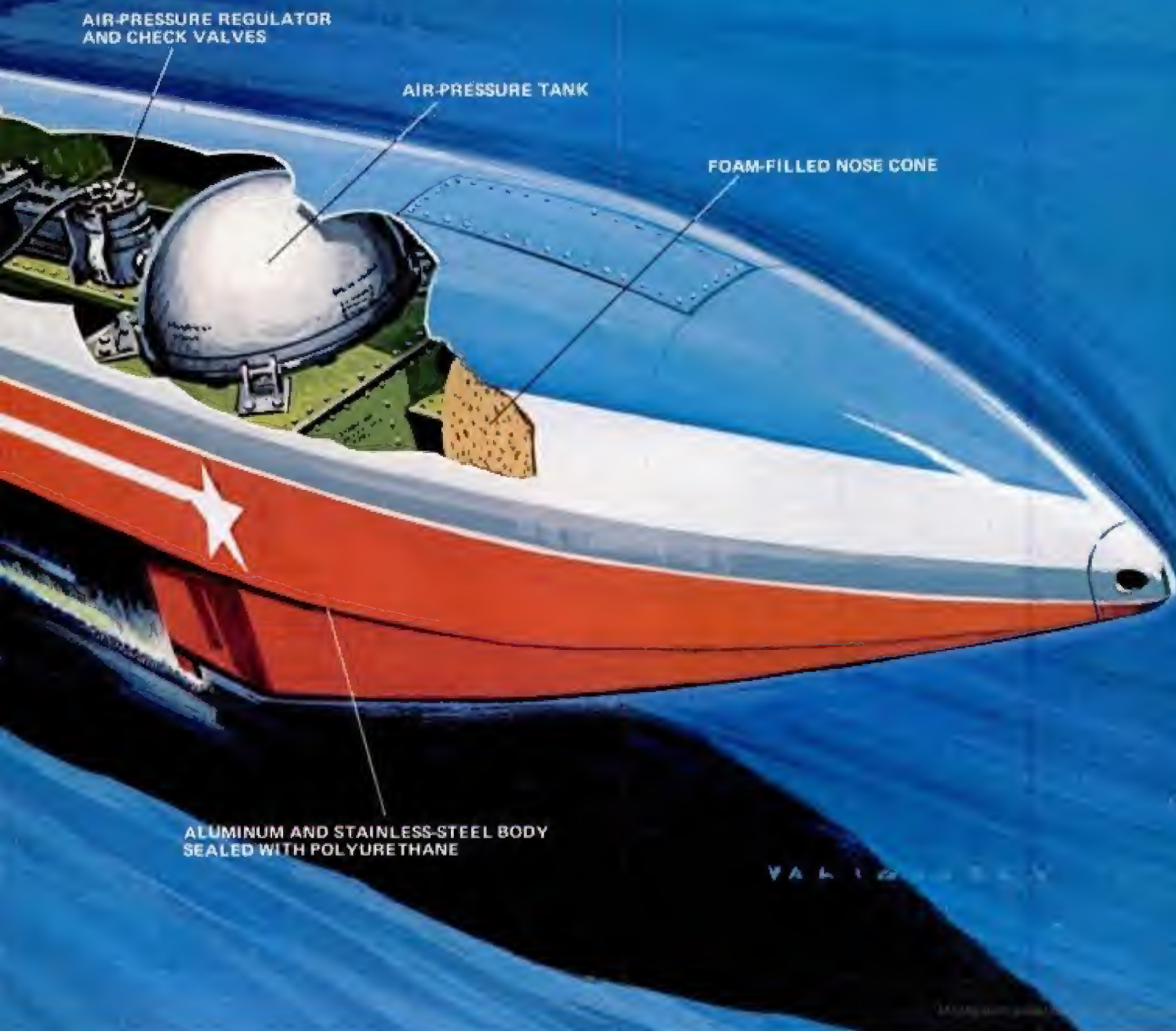
ward of the driver's compact cockpit, the other directly behind the driver. The all-important cylindrical air-pressure vessel is mounted 14 feet from the bow of the boat and will be able to maintain a constant pressure of 3000 pounds per square inch. Between this pressure tank and the fuel tanks are air/fuel regulators, block valve and check-valve system, all of which are pilot-controlled from the cockpit. The right-hand-mounted throttle with which Taylor will turn up the boost also feeds information to three separate gauges that monitor the air/fuel mixture and pressure. All fuel lines and fittings are of aircraft quality and

designed for the safety and protection of the pilot.

The steering system contains a rudder that sits in the water, as on any conventional boat, and also an aircraft-type steering rudder on the vertical stabilizing tail, rising 9 feet above the water. When *Discovery II* reaches high speed, it leaves the water, and only a 4-inch extended skeg below the boat's transom remains below the surface as a fixed guidance device. With all conditions right, everything else is in the air and the boat is a rocket-powered missile with essentially unlimited top speed under proper smooth-water conditions.

Once all this gets moving, it gets

*(Please turn to page 158)*





# How we'll build a

The challenge: Build a zero-maintenance pump small enough to fit behind the ribs.

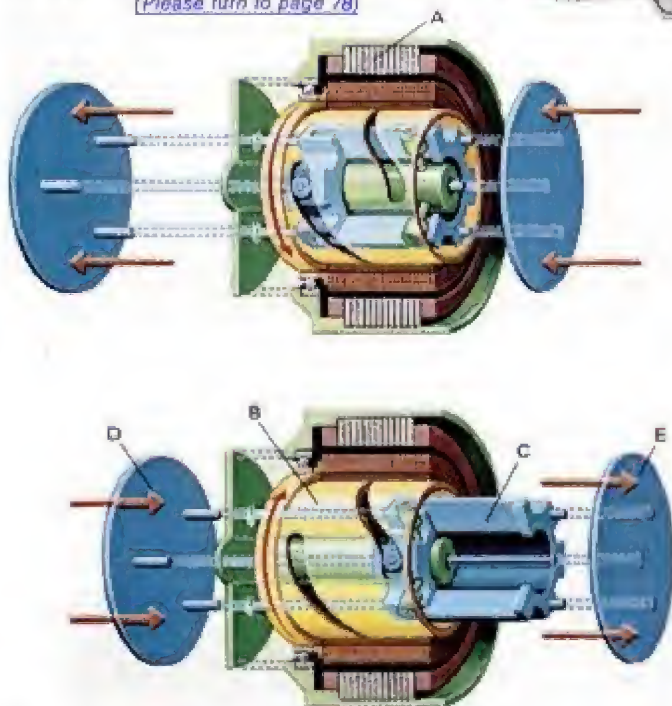
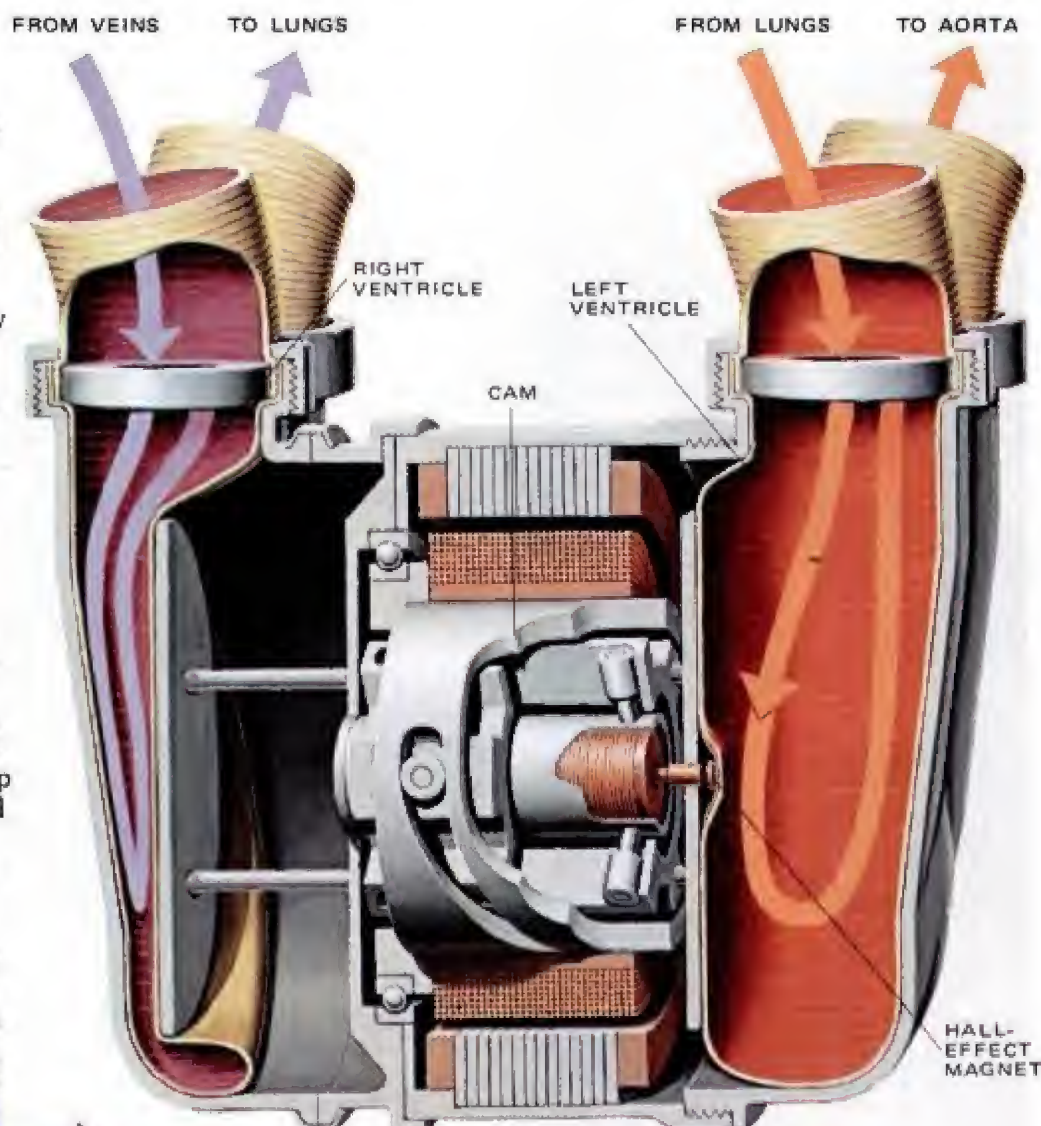
by Gurney Williams III

**A** 200-pound calf recently suffered a man-made heart attack at the Milton S. Hershey Medical Center in Pennsylvania after researchers injected tiny spheres into one of its arteries. But within a few days, its blood surged through its body at a normal 10-liter-a-minute pace. His appetite returned. He was able to stand.

The cure, like the cause, was man-made. A carefully engineered mechanical pump the size of a large fist helped thrust blood into the animal's main artery and out to its organs and muscles.

The pump, called a Left Ventricular Assist Device (LVAD), is a critical piece of hardware in a challenging, competitive research effort

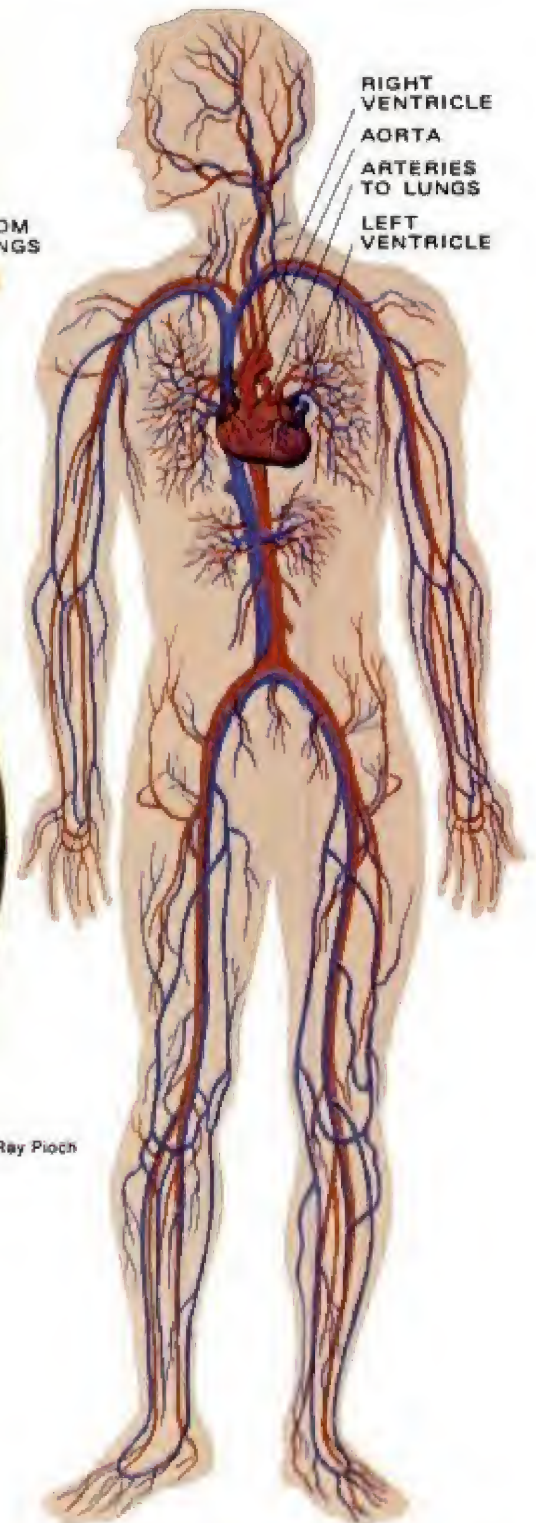
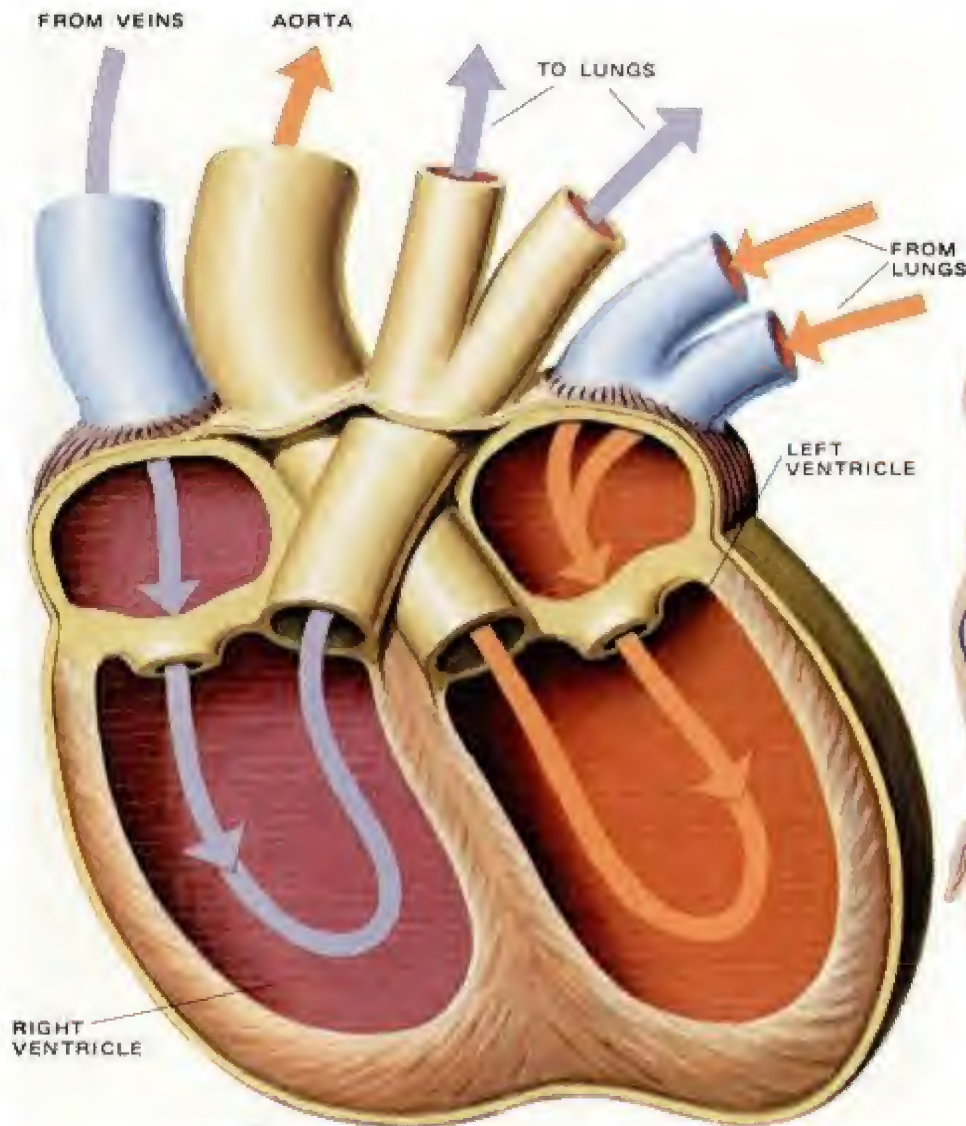
(Please turn to page 78)



Prototype heart (in photo and cutaway, above) substitutes electric motor for heart muscle. In Hershey Medical Center design (left), stator (A) causes cam (B) to rotate 216°. As cam turns, it moves pusher-plate actuator (C) toward right or left depending on cam rotation. Pusher-plate actuator connects to pusher plates (D and E). Plates impinge on smooth polyurethane sacs duplicating chambers in human heart. After plate pushes blood out of one sac, cam reverses to pump blood from the other. In the biological heart (opposite page), both chambers contract at once.



# working human heart



Illustrations: Ray Ploch



Hershey researchers adjust the Left Ventricular Assist Device on calf. Similar device has been used as a "crutch" for weakened human hearts.

In biological heart, left ventricle pumps oxygenated blood into aorta, body's main artery. After circulation, blood returns in veins to right ventricle. There, it is pumped to the lungs to receive new oxygen supply before entering the left ventricle. Pumping rate of Hershey artificial heart is set by devices continuously sensing the blood pressure in the circulatory system.



to build an implantable, artificial human heart. At least 20 centers here and abroad are working toward the creation of an almost perfect machine, a double-chambered, self-contained pump capable of moving roughly five liters of human blood every minute, or 2.6 million liters a year, with zero downtime for the years between replacement operations.

Despite these formidable specs, researchers have developed several different designs—including one for a nuclear-powered human heart—and kept animals alive for weeks on prototypes (the record is 7½ months, for a calf in Utah) after removing their natural hearts.

### Fix it or remove it

Whirring, clicking hearts are dramatic evidence of a new direction in medical research. "Traditionally, medicine has attempted the alleviation of pain or of disability," said Dr. Pierre Galletti, a professor of medical science at Brown University. "Next came preventative medicine. Now we are at the threshold of substitutive medicine—'If you can't cure it, get rid of it and replace it.'"

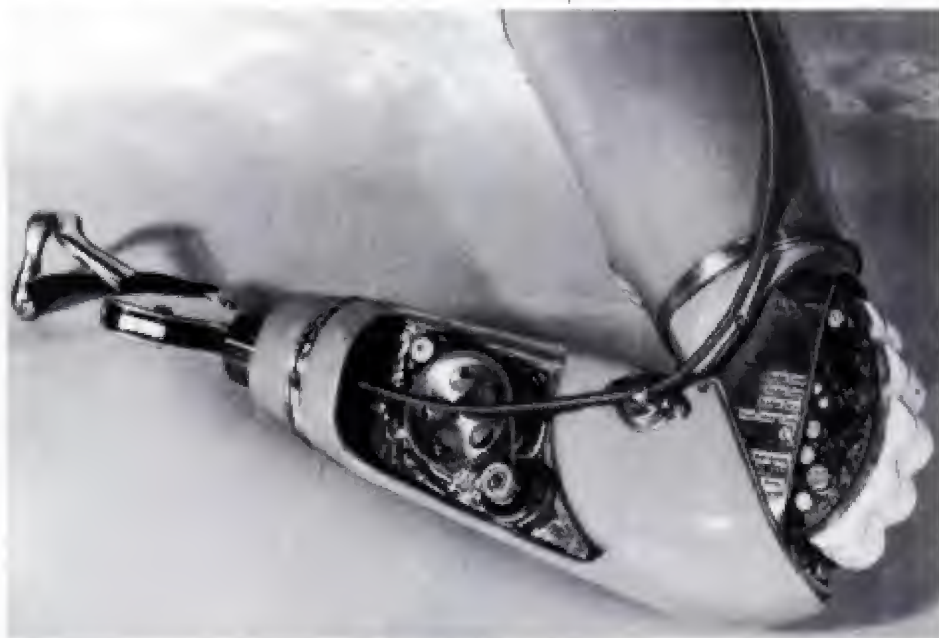
Artificial body parts have come a long way from the ill-fitting, hand-carved wooden leg. Today's labs are building implantable internal or-

gans, as well as arms and legs, and keeping test animals alive with them:

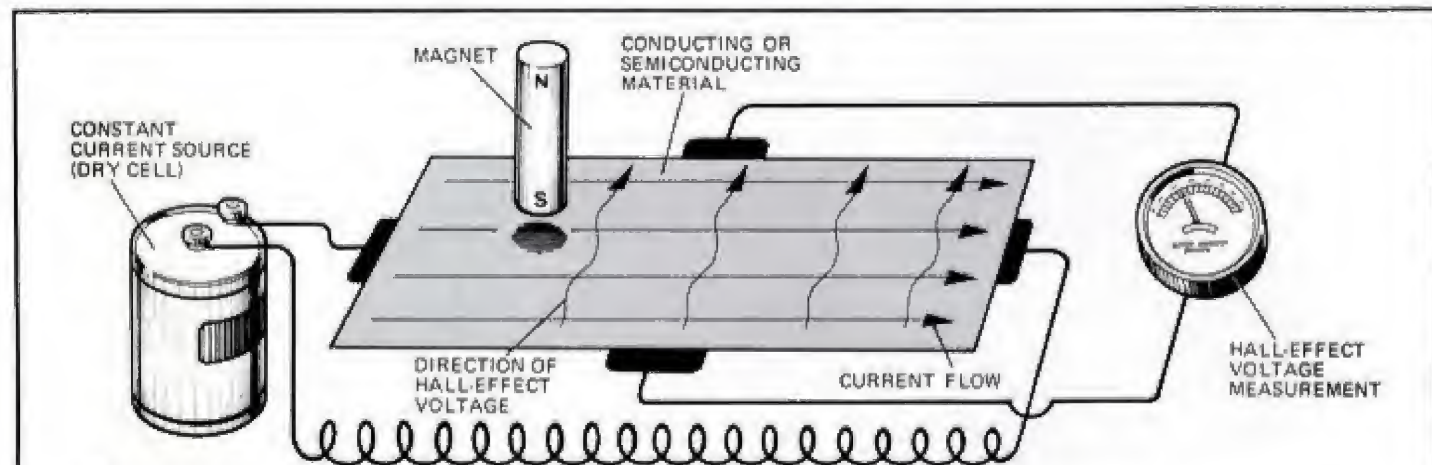
■ Galletti himself is at work on a device to replace diseased lungs. In a typical experiment, he removes one lung from a sheep, then connects the animal to an artificial substitute lung made of teflon tubing coiled inside a plastic bag blown up with oxygen. The sheep's blood runs through

the tubing, porous enough to let the oxygen in without leaking blood. So far, it's worked on half a dozen sheep, he told us, although use in humans is at least a decade away.

■ Galletti has also connected rats and dogs to an artificial pancreas, developed in collaboration with researchers from Harvard, the Massachusetts Institute of Technology (M.I.T.) and Amicon Corp. The nor-



Artificial arm under study at the University of Utah contains computer circuitry to analyze electrical activity in shoulder muscles, and then control battery-operated motors.



### The Hall effect—a key to the heart

When considering a switching device to regulate pumping of an artificial heart, two factors come immediately to mind: reliability and durability. The human heart cycles about 40 million times a year—well beyond a reasonable operating life for mechanical switches. Fortunately, there are solid-state switches available that have *no moving parts* and therefore no wear. The one chosen for the Hershey heart is known as a Hall-effect device, developed by Micro Switch, a division of Honeywell.

The Hall effect, named for Edward H. Hall, the Johns Hopkins graduate student who defined it in 1879, has preoccupied a few theorists for nearly a century. Yet it is unknown to

the general public and had no commercial application until Micro Switch perfected a solid-state switch in 1968.

What Hall found was that if magnetic force lines were perpendicular to an electrical current flow (see diagram) and the magnet was brought close to a conductor (Hall used gold foil), a "pressure" to deflect the current in the conductor—later to be called Hall voltage—seemed to arise. It was as if some force were trying to push a noncompressible fluid like water to the side of the pipe in which it flowed. Hall found that this voltage increased with the strength (or proximity) of the magnetic field and also with the strength of the original current—and later experimenters found Hall

voltages even higher when certain semiconducting materials replaced the conductor.

It remained for Micro Switch to digitize a Hall-effect device, which meant that it would produce Hall voltage that is either "on" or "off," depending on whether the magnet has crossed a predetermined threshold.

Thus can a sensor the size of a pinhead "feel" the approach of a small magnet attached to the flexible wall of the Hershey heart's left ventricle, and accurately control the pumping rate. Tests at Micro Switch have Hall-effect switches operating reliably after 12 billion cycles. Computed in terms of human heartbeats, that's 300 years.



mal human pancreas, a long, rounded gland at the back of the abdomen, secretes enough insulin hormone to allow the body to use blood sugar efficiently. In diabetics, insulin levels are too low. To build an artificial pancreas, Galletti seeds the outside of a porous tube with live, insulin-producing pancreas cells. When the tube is spliced into an animal's circulatory system, these cells sense insulin levels in the blood. They secrete proper amounts of the hormone through the porous wall of the man-made tube. It's worked for up to a week on dogs, he told us, and might be available for diabetics before the end of the decade.

■ Johns Hopkins researchers have used artificial blood clots to treat more than 50 human patients. Natural blood clots, of course, can be a medical disaster, blocking off blood supply to the heart or the brain. But man-made clots, carefully placed, can help save lives. Before an operation on one 56-year-old Baltimore woman to remove a tumor from her liver, Dr. Robert I. White Jr. inserted a thin, hollow catheter into a vessel supplying blood to the growth. At the tip of the catheter was the artificial clot: a tiny, deflated balloon made of clear silicon. Using an X-ray dye, he monitored the movement of the catheter until the balloon was in a perfect position to dam the flow of blood to the tumor. Then he filled the balloon with dye to a diameter of about one-quarter inch, just enough to block the blood. The procedure guarded against life-threatening hemorrhage when surgeons successfully removed the tumor.

■ Other researchers have filled the plastic shells of artificial arms with

computer circuitry in recent years, to analyze electrical activity in shoulder muscles and direct motorized elbow flexions and grasping movements in artificial hands. One model, built by Dr. Stephen C. Jacobsen at the University of Utah, carries a battery pack good for at least 2500 elbow movements before recharging. The prototype picks up minute signals from two sensors on biceps and triceps muscles to control elbow movement. Motors in the arm can lift five pounds with the speed of a natural arm.

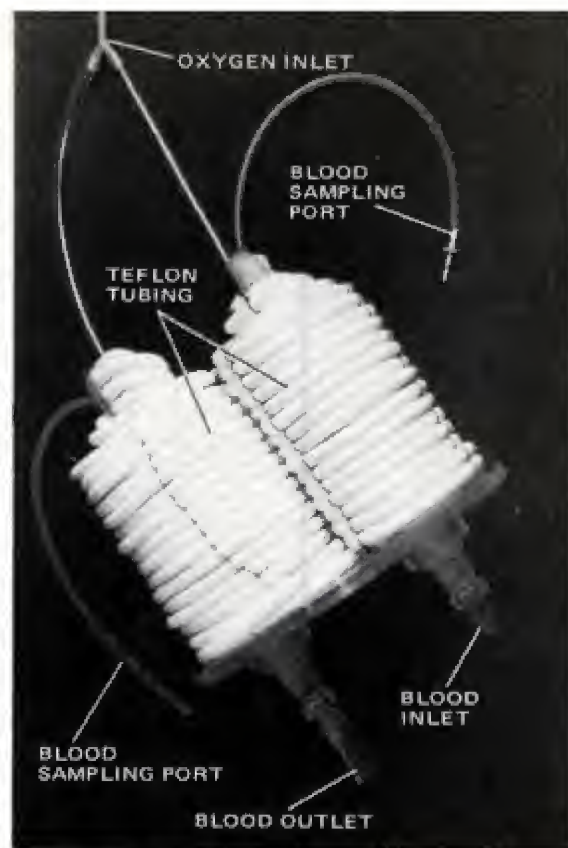
### A crutch for heart patients

Some of the most imaginative work has gone into building components of a human heart, coronary parts that will eventually be fitted together to make a total artificial organ. In the meantime, doctors have used some of the components as a crutch for ailing hearts.

One patient at grave risk at the Hershey Center was a 39-year-old mother of four from northern Pennsylvania. Rheumatic fever had damaged a heart valve, preventing an unobstructed flow of blood into her left ventricle. This chamber on the left side of the heart receives oxygenated blood from the lungs, and pumps it up into the aorta, the main artery of the body. Dr. William S. Pierce put in an artificial valve, while a heart-lung machine took over the work of oxygenating and circulating her blood. The operation proceeded smoothly. But when the heart-lung machine was disconnected, her heart would not pump well enough to keep her alive.

Ten years ago she would not have survived. But by the time of her operation in 1977, Hershey research-

**Artificial pancreas (left) has maintained insulin levels in rats and dogs. Inside device, blood circulates through porous tube (below) whose wall is coated with live pancreas cells. These sense hormone level in blood and secrete adequate insulin through wall to enable body to use blood sugar efficiently. Device may be used in humans within 10 years.**



**In artificial lung, a plastic oxygen bag (not shown) encases porous Teflon "vessels."**

ers had perfected their LVAD enough to connect her to it. She wore the small pump outside of her body. Its polyurethane chamber received blood through a tube and then, powered by a pneumatic pump, it delivered a spurt of blood into the aorta at precisely the right time to complement the weak effort of her own heart. Pierce gradually weaned her from the device by reducing its pumping. After eight days, her own heart took over completely. She went home, and lived for more than a year. The cause of her death is unknown.

Since the first LVAD operations three years ago, the mechanical pumps have been connected to 14 patients at Hershey, all of them in imminent danger of dying. The woman and a man, discharged last summer and still alive, were the only survivors. Other medical centers, using different designs for the LVAD, have had about the same success. Of 15 patients attached to mechanical heart pumps at Children's Hospital Medical Center in Boston, there have been just three long-term survivors.

But small as it is, the survival rate among these critically ill patients is remarkable, considering the problems with such mechanical pumps that seemed insurmountable just a short time ago.

In his office overlooking the rolling farmland around the Hershey Center, affiliated with Penn State University, Pierce recalled some of

*(Please turn to page 162)*



## Big wheel

Ken Wilson thinks tricycles may help solve the energy crisis. But he's not high on currently available three-wheelers, because they don't corner very well. Enter Wilson's Carriage Cycle. It's articulated in front, so the rider's part of the trike leans into a turn. Combined with a leaf spring

suspension (right), it permits riding on rough terrain; the three wheels give stability on ice, snow and in the rain. The inventor claims it's perfect for carrying loads like groceries. The Chenoa, Ill., resident uses a chain and sprocket (below right) for front-wheel steering.



## Electronic washer



A single-chip microcomputer controls this washing machine. The user punches in type of material being washed, degree of dirtiness and size of load; the machine picks the optimum washing program and lowest possible consumption levels of electricity, water and detergent. Made by AEG-Telefunken of Germany, the machine can make its own repair diagnosis.

## Against the wind

High winds can accelerate heat loss from, and cause physical damage to, greenhouses. An artificial windbreak made of a material called Paraweb is said to be able to reduce heating costs as much as 25

percent in stiff winds. The webbing, made by ICI Ltd. in England, is claimed to be virtually indestructible and unaffected by weather. It is also used in crop protection, sand-dune control and snow fencing.





## Riding on air

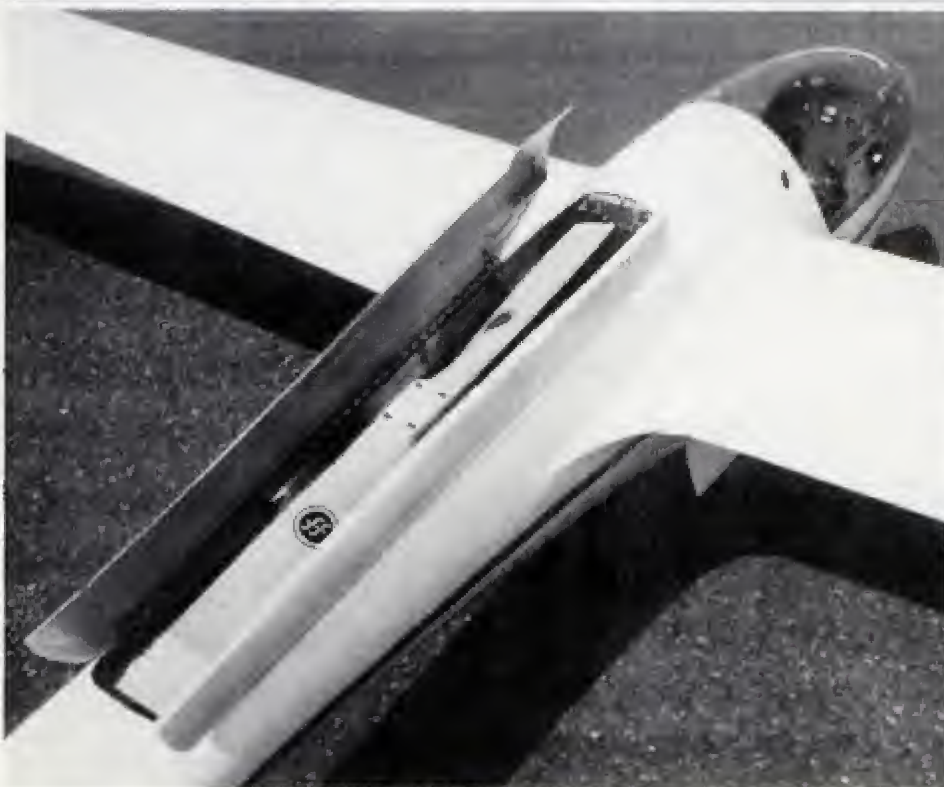


Called the world's first and only inflatable ice chest, the Nautilus comes in seven-quart size (seven cans plus ice cubes) and also in other sizes up to 48 quarts. When not used to keep drinks cold, it'll keep cameras and binoculars protected from travel bumps and important gear afloat, if a sudden rain should come or a canoe capsize. Each of the five models is a different color; price ranges from \$14.50 to \$27.50. The chests deflate to stow compactly.

## Digital delight

Electronic technicians and hobbyists can now purchase a logic probe as an inexpensive kit, and get high-quality performance in the bargain.

The probe is indispensable for use in troubleshooting digital electronics. It's available at \$19.95 from Global Specialties Corp., 70 Fulton Terrace, New Haven, Conn. 06509. (It's listed in their catalog as probe model LPX.)



## This glider can do it all

The Pik-20-E is the first production sailplane to sport a retractable engine. The powerplant obviates the need for a tow-plane and comes in handy in an emergency.

By hand-cranking the engine and the prop into the fuselage, the pilot turns the plane into a competitive, high-performance glider with a 15-meter-wingspan, the maker claims. Carbon fibers are used in the wing spars to save weight; empty, the plane is 640 pounds. The engine is a 500-cc, 43-hp two-stroke. Top speed is 174 mph.

Manufactured in Finland by Eiriavion, it is distributed in the United States by Smitty's Soaring Service in Clinton, N.Y. This aircraft may be purchased for \$43,000 complete.



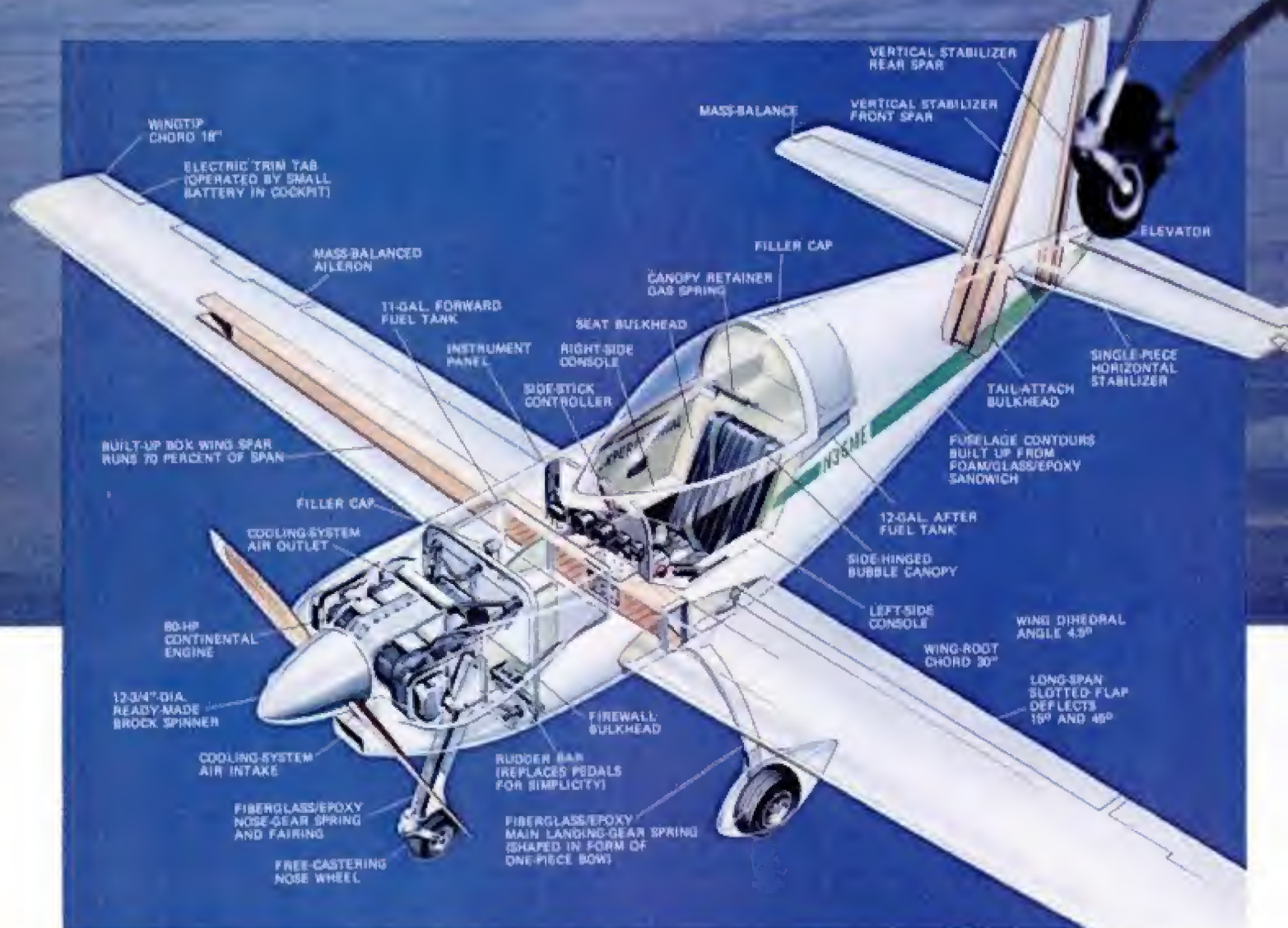
A white biplane is shown in flight against a clear blue sky. The plane is angled upwards and to the right. The propeller is blurred, indicating motion. The text 'allons... air race!' is overlaid on the left side of the image. Below it, a paragraph of text describes the plane's capabilities. At the bottom left, the author's name 'n M. Gallagher' is visible.

# allons... air race!

ports plane gets 40 miles  
re than 180 mph, and has  
in one air race. You can  
nd kits for under \$5000.

n M. Gallagher

by Sheldon M. Gallager



Low weight and clean lines give this all-composite speedster impressive performance on modest power. Streamlined wheel pants and fairing on the nose-wheel strut were added after photo (above, right) was taken, upping speed 10 mph. Ground steering is by differential braking; nose wheel is free-castering. To keep weight down, there's no radio or engine starter, though they can be added.





PM photo Bill Pierce

**G**eorge Mead didn't start out to build an air racer, but the trim little craft he came up with has been performing so well it's beginning to *think* it's a racer. George entered it in last summer's Oshkosh 500—a 500-mile, closed-course pylon race for sports planes—and surprised everyone, including himself, by coming in a respectable third in a field dominated by veteran race pilots.

Mead's creation, aptly named Adventure, is a sleek, single-seat, tri-gear monoplane designed for easy construction, safe handling, economical operation and—are you ready?—high performance. High *what*? On the face of it, this last claim seems improbable. Easy-to-build, easy-to-fly airplanes aren't supposed to be inspiring performers. Yet George has managed to pack a remarkable amount of excitement into his tiny speedster. It hits 188 mph flat out, has a high-speed cruise of 175 mph, and climbs like an express elevator at 1600 feet per minute. While not intended for unlimited aerobatics, it romps nimbly through loops, rolls and most other maneuvers an adventuresome pilot would want to

(Please turn to page 153)



Ailerons are tiny—only 24 inches long—but are mass-balanced, highly effective. Numeral 4 on wing is plane's race number.



Fighter-style side-stick controller is at right in cockpit. Center handle is flap control, extra long to give good leverage.



Side-hinged canopy opens out of way for easy entry. Slot in nose cowl is exhaust port for novel forced-air cooling system.



# DON'T GET BURNED BY

Lured by growth of the solar market, hundreds of novice installers are

**A**braham M. Genen bought a solar system for his Orange County, N.Y., house that didn't work anywhere near as well as it was supposed to. The contractor promised a 50-percent efficiency. The actual performance, Genen estimates, is 10 to 15 percent.

What makes Genen's experience especially illustrative is that Genen is not just any buyer. He is a senior

consumer-fraud expert in the New York State Attorney General's Office. One of his specialties: solar energy. In fact, Genen, a 14-year consumer-fraud veteran, got his solar assignment about the same time he got his solar system. He could have been his first complaint.

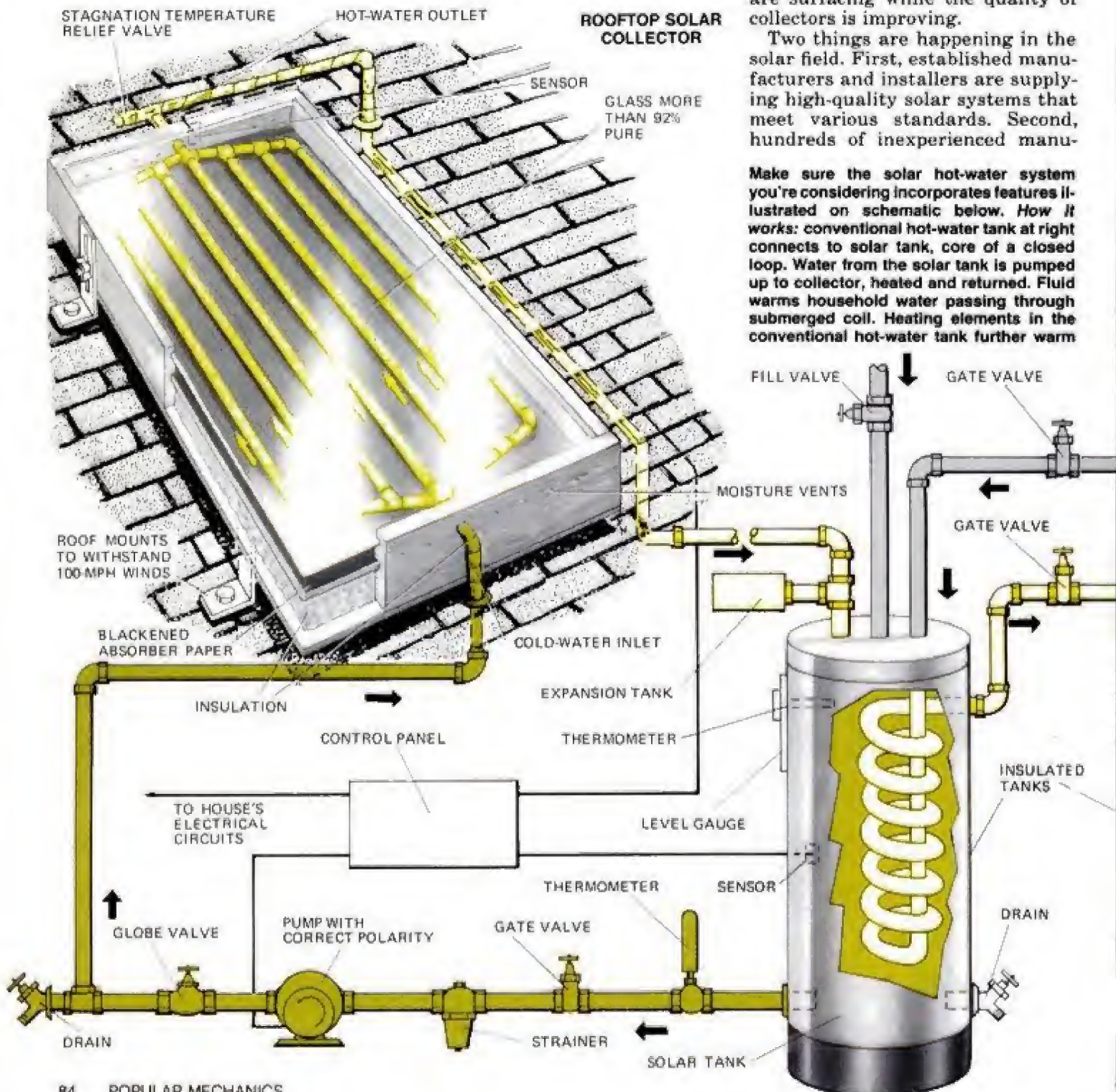
"I asked a lot of questions," he said. "I got data and statistics. They were as phony as a \$3 bill." Now he's

suing the contractor. He says he would do it differently next time, but his first solar system has brought him nothing but, as he says, "tsouris," the Yiddish word for "aggravation."

Genen is part of a growing subculture that has found solar energy in practice to be far different from solar energy in theory. Even more ironic is that numerous complaints are surfacing while the quality of collectors is improving.

Two things are happening in the solar field. First, established manufacturers and installers are supplying high-quality solar systems that meet various standards. Second, hundreds of inexperienced manu-

**Make sure the solar hot-water system you're considering incorporates features illustrated on schematic below. How it works:** conventional hot-water tank at right connects to solar tank, core of a closed loop. Water from the solar tank is pumped up to collector, heated and returned. Fluid warms household water passing through submerged coil. Heating elements in the conventional hot-water tank further warm





# SOLAR RIP-OFFS

by Stuart Diamond

selling inferior systems.

facturers and installers—attracted by the astronomical growth of the solar market—are profiting by selling inferior work. Today, perhaps 200,000 solar systems—largely domestic hot-water—dot this country, and the figure more than doubles each year. The number of competent solar firms has not kept pace with demand, experts say.

"When they opened the door, everyone came in, including the incompetents," says Edward Bohrer, president of California's Southwest Energy Management, which is highly regarded by federal officials. Bohrer said fully 20 percent of his business involves fixing systems installed by someone else.

the water as necessary. Sensors—one in the solar tank, one in the collector—turn on the pump when the collector temperature is at least 10° hotter than the temperature in the solar tank. Potential problems range from heat waste, caused by inadequate insulation on pipes or tanks, to blowouts, caused by pump failures and overheating. Good solar systems are able to save you as much as 80 percent of fuel bills.



What's wrong with the picture above? Haphazard orientation of collectors reduces efficiency. Ideally, collectors should face no more than 15° east or west of true south. Moldings lifting on collector surface (below) is evidence of poor construction.

Disheartening evidence of recent problems comes from an inspection of 60 systems early this year by the Florida Solar Energy Center, a state agency.

Only three of the systems checked were found to be problem-free. Fully 24 had more than routine design and installation problems, 13 had serious problems and seven didn't work at all. Even Randy Dyer, associate director of the Solar Energy Industries Assn., conceded that inexperienced labor has proven to be a serious problem in a significant number of cases nationwide.

In a number of southern California houses, workers installed systems by following the manufacturer's directions exactly: Install the collectors to the north, facing the sun. Unfortunately, the collectors came from Australia. In the United States, the sun comes from the south.

"The problems go from the ridiculous to the very subtle," observed Lynda Connor, who manages solar consumer programs at the U.S. Department of Energy.

## Large rewards possible

The rewards for selecting the right system are large: A tax credit (See *How Energy-Saving Home Improvements Can Save Tax Money*, page 136, Sept. '79), thousands saved on fuel bills and a jump in a house's resale value. A problem-free solar system is completely automatic. But to reap those rewards, consumers must first use sound buying prac-



tices, as they would for any major purchase.

Here, is how to avoid getting burned when you buy a solar system.

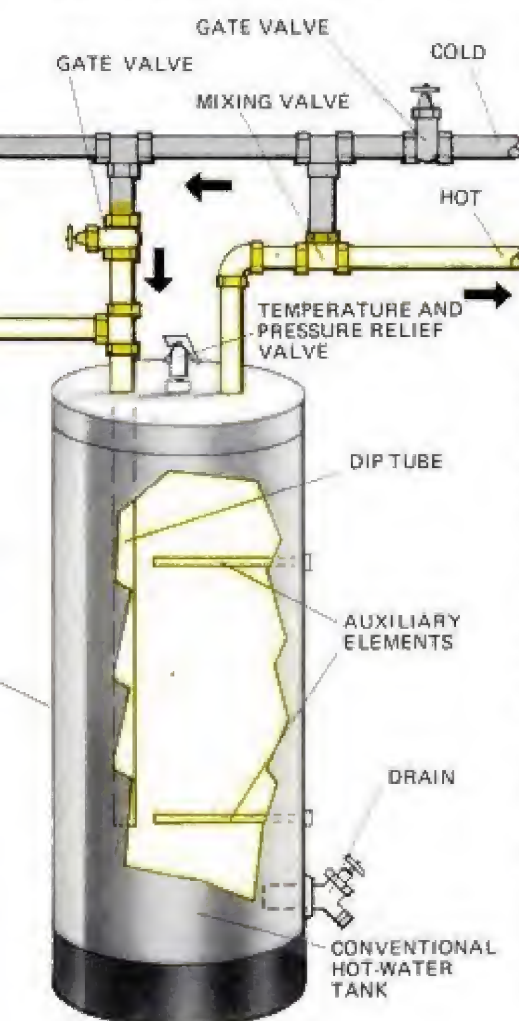
## Collecting information

The first step is to gain as much detailed information as possible on solar systems—how they work, who makes them, performance data, economics, different designs, local installers, problems. Contact the federally funded National Solar Heating and Cooling Information Center (see page 134 for the address of the Center and other helpful agencies), perhaps the world's largest such solar outlet. Almost everything they supply is free.

Make sure you ask for the *Domestic Hot Water Heater Installation Guidelines*, an invaluable document that will help you install—or scrutinize—any system.

Send for the Solar Energy Industry Assn.'s *Directory of S.E.I.A. Cer-*

(Please turn to page 131)







The Comuta-car's small size and quick reflexes enable it to zip through any traffic situation.

# Living with an electric car

We take home a production electric car and get a charge . . . and some shocks.

by Tony Assenza AUTO EDITOR

**O**wning an electric car these days is probably one of the last great opportunities the average motorist has of exercising his pioneering spirit. The current state of development of these volt guzzlers is comparable to that of aviation a few years after the Wright brothers flew their first hundred yards. In that sense, anyone who buys an electric is embarking on a trip through uncharted territory. He leaves behind the automotive world as we know it and, like any pioneer, is left pretty much on his own, to sink or swim as best he can. I discovered this one evening when the batteries gave up, leaving me stranded in the middle of the Brooklyn Bridge.

In a gas-engine car, running out of fuel isn't yet a major problem. But who do you turn to when you need to revitalize 200 pounds of dead batteries? Have you ever tried calling the



JPM photos: Ralph deMasi

AAA and asking for 12 batteries? I can guarantee that their answer is anything but encouraging.

The problem is that nobody in the entire country is able to provide this unique type of emergency road service. The only recourse is to ride home slung off the back of a tow truck. And that's a very uninspiring position, especially for a pioneer.

Fortunately, that night on the bridge I didn't need a tow truck. A good Samaritan named Serge from Trenton pushed me off the bridge to a gas station, one of the greatest institutions of the 20th century. Where else can you get anything from a loaf of bread to a rebuilt transmission . . . and a charge for a dead electric car?

I never got a chance to properly thank Serge from Trenton. He took off in his Beetle before I even got a chance to get his full name. So,

wherever you are, Serge, thanks for the push.

Getting stranded far from a plug was the worst that happened with the electric car. But once I got it safely home, life became less complicated and actually very enjoyable. All I had to be aware of was the state of charge and my mileage. As long as I stayed within the range limit, the car was as effortless to live with as a gasoline-engine car.

While tooling around the neighborhood I discovered something else about owning an electric. Short of passing out hundred dollar bills on a street corner, having this car is the best way of making friends ever invented. Park it and it will draw more crowds than the Super Bowl.

## Tough as a football helmet

The object of all this attention on the street, our test vehicle, is called



Comuta-car. It is one of the few electric vehicles currently available for sale. There are dozens like it in various stages of testing and evaluation but none of those are on the market. The reason we picked this car was its availability and the reasonable price, just under \$5000. The few other electrics available cost a lot more.

What you get for the money is a sturdy, two-passenger car that carries 13 batteries in an aluminum floorpan, all wrapped up in a Cycolac ABS plastic body shell, the plastic used to make football helmets.

To meet the government's crash tests, the manufacturer placed four of the batteries in a tray in front of the car. In a head-on collision, the tray is designed to absorb most of the impact and prevent the batteries from being pushed into the passenger compartment. A similar arrangement is at the rear of the car.

To provide even more occupant protection, a roll bar is installed over the seats and another crash bar runs beneath the dashboard. There is still another bar that runs down both sides of the windshield. This roll-cage arrangement is similar to that used by race cars.

While the interior lacks most of the luxury touches found even in subcompacts, it is not uncomfortable. There is no seat adjustment, but anyone under 6 feet should have no trouble being comfortable.

In fact, no one should have much trouble adapting to driving this car. It works pretty much like any other car with automatic transmission.

To get the car under way, you insert a key and turn it. But, instead of hearing an engine turning over, there is silence. The red parking-brake lamp goes on. The parking brake is an interlock mechanism that prevents current from reaching the motor while the brake is engaged.

Forward and reverse are selected by a three-position toggle switch; forward is up, middle is neutral and reverse is down. The switch can't accidentally change position.

Once the switch is positioned, a tap on the accelerator will get the car rolling. The accelerator in this case is a conventional pedal that controls the amount of electrical power delivered to the engine. There are three forward and reverse speeds, each one automatically activated by relays when the accelerator is depressed. When you're driving, the only sound the car makes is the whine of the electric motor and the clicks of the relays as each one is activated.

The instrument package consists  
(Please turn to page 173)

## A HANDSOME HYBRID, BUT YOU CAN'T LIVE WITH IT—YET



Two rear axles are used to evenly distribute the weight of the batteries. On the road it cruises at over 60 mph. Diagram illustrates twin-engine layout.

Thus far, no fully practical vehicle that is entirely gasoline-free has been perfected. But after 18 months in the works, the Briggs & Stratton Corp. (the world's largest manufacturer of small internal-combustion engines) has unleashed the next best thing: the Gasoline/Electric Hybrid. This sporty, family sedan can be driven by either its 8-hp Baldor, series-wound d.c. electric motor or an 18-hp Briggs & Stratton gasoline engine. Or it can be driven by both together to produce variable gas mileage from 25 to 150 mpg.

While some of the major automobile manufacturers are just now receiving large government grants to experiment with such vehicles, the Briggs & Stratton Hybrid is already being tested. It's a roomy, contemporary, aerodynamically sound, good-looking car with passable performance, maximum fuel efficiency, and the one big thing all pure electrics have lacked: long-range capability. The car offers a range of approximately 60 miles under battery power, but when that cuts out, the driver just switches on the ignition and motors happily home under gasoline power. Combined range: over 300 miles.

When Briggs & Stratton undertook the hybrid project, one of the first choices to face project engineer Doug Janisch and then vice president of research and development Bob Harkness was between the two common approaches to combining gasoline and electric powerplants. The first—and simplest—



method is to add an engine-driven generator to the electric motor to recharge its batteries. This "series-hybrid" design adds nothing to the electric motor's performance, however, only its range, and suffers significant mechanical-electrical-mechanical conversion losses that make it an inefficient system. According to Harkness, "the series system loses energy at every step, and it takes a very complicated electrical circuit to take large inputs of energy from the generator and store them into the batteries."

Thus, Briggs & Stratton has employed the "parallel-hybrid" principle, whereby the heat engine is directly connected to the electric motor, applying its power mechanically to the driveline. In addition to acting as a reserve when the electric power is depleted, the gasoline can be—and usually is—used as a supplement to the electric motor to produce increased power.

On level ground the electric motor will propel the car at about 45 mph, the gasoline engine at about 44. Under hybrid power—gasoline and electric together—the car will cruise easily in the low 60s.

With the parallel-hybrid system, no attempt is made to recharge the batteries during the car's operation. That is accomplished at home, via two chargers, in anywhere from two to eight hours at a cost of anywhere from 75 cents to \$3.75, depending on the time of day (night rates are cheaper) and the cost per kilowatt in your area.

Driving the Hybrid differs very little from driving an ordinary car. Starting up is as easy as flipping on a light switch, in this case a toggle located on the lower left portion of the dash. What is disconcerting is that, even with the switch on, the car makes absolutely no sound. Press the accelerator, however, and it

(Please turn to page 173)

FM photos: Dave Gootley



The little internal-combustion engine is hooked up directly to the electric motor.





**1** Weak signal causes this type of interference. There might be antenna-line losses or similar problems. Text gives solutions.



**2** Electrical—bands of snow.



**3** FM radio—hash-like stripes.

# 8 WAYS TO BEAT TV INTERFERENCE

by Jorma Hyypia

**A** few years ago, there was considerable hoopla about the alleged disruption of television by citizens band radio. Today, there are rumblings and grumblings that hobby computers are the real TV-interference culprits. Tomorrow, latter-day Don Quixotes bent on protecting the purity of TV transmissions may have reason to joust with *real* windmills, as well as with CB radio and computers.

## 1. Weak TV signals

These can be mistaken for television-interference (TVI) problems. If all channels have the same grainy, degraded appearance, look for corroded or broken connections all along the lead-in cable, from the antenna to the TV set. This type of maintenance is indicated if you formerly had good reception. If you have never had satisfactory picture quality, you may need a better antenna, or the existing antenna should be placed higher up and per-

haps be fitted with a signal amplifier for improved reception.

If only one or two channels have the overall grainy appearance, your cable connections are probably in good shape. Perhaps you are simply located in a fringe area with respect to the particular channels affected. Better antenna orientation (direction and height) and use of a signal amplifier should solve the problem.

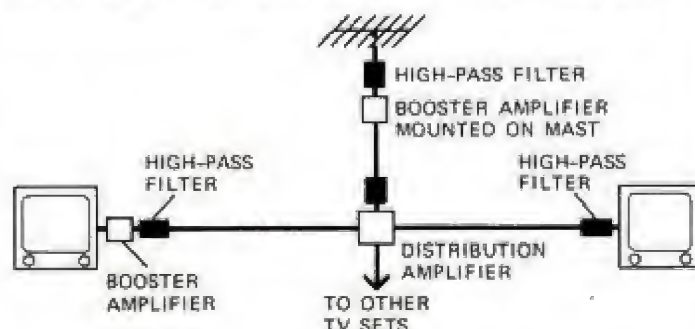
## 2. Electrical interference

If very pronounced, this might be mistaken for a weak signal condition, although the two effects are ac-

tually quite easy to differentiate. A weak signal causes uniform degradation of the entire picture area. On the other hand, even severe electrical TVI tends to form changing bands of flickering, short, horizontal lines, or else more randomly spaced, bright pinpoints of white light. The latter effect is very common when an electrical storm is in the viewing area.

If you observe pinpoints of light dancing around on the screen when there is a breeze blowing outside but no storm, check the lead-in wire connections to the antenna. Odds are

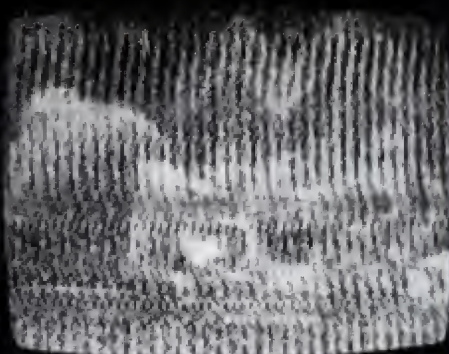
High-pass filters can be useful if installed as shown here. Don't forget to put one on each side of a booster amp. Try the three cures at far right to solve the interference from appliances or dimmer switches—but be careful of a.c. wiring if you make modifications.







**4** Computer—similar to radio.



**6** CB radio—pulsing lines.



**7** Co-channel—different images.



**5** Ghosts—multiple imaging.



**8** Airplanes—picture tears.

Recognizing what's wrong is the first step to improving poor TV reception. Here are the most common problems and the solutions.

you will find at least one connection either badly corroded or broken off.

To track down other intermittent electrical TVI, go around the house and turn off operating appliances one by one.

If a portable radio is affected by the same interference, carry it around your home area and see where it sounds noisiest. It's just possible that you will get loudest radio interference when you move closer and closer to a neighbor's property; maybe his appliance or engine is creating the problem.

If the interference is caused by a power drill or saw, you may live with the minor nuisance. However, any appliance that causes persistently annoying disruption of TV or stereo equipment performance should be corrected (see illustration).

### 3. FM radio interference

This can be caused by a nearby FM broadcast station and may create a herringbone pattern that is easy to confuse with a similar pattern caused by misadjustment of the TV set's fine-tuning control. If the tuning control is at fault, the inter-

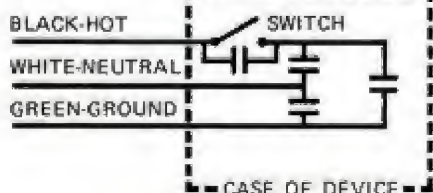
ference pattern fluctuates with sound changes in the TV program; if FM interference is present, the pattern fluctuates with variations in the sound of the FM broadcast, not with the sound of the TV program.

FM TVI is usually most bothersome on Channel 6, although other channels in the 2 to 13 series may also be affected. Before attempting a cure, make certain that the FM interference is not caused by a nearby FM receiver.

To become familiar with FM interference, hold a portable FM receiver

*(Please turn to page 126)*

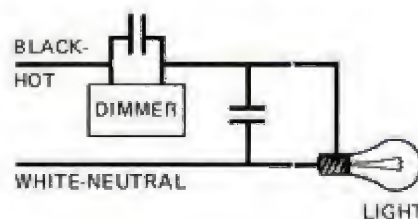
POWER CORD



C=.001 MFD., DISC CERAMIC



C=.001 MFD; DISC CERAMIC



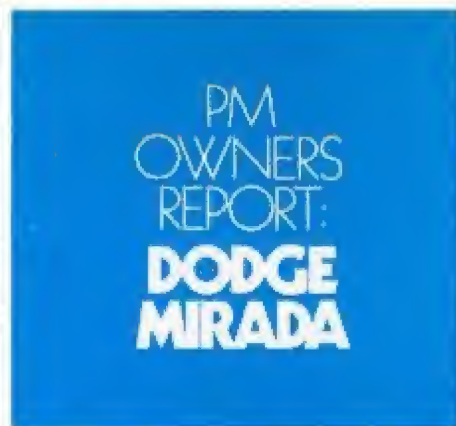


**N**ever underestimate a pretty face. Nearly 80 percent of the Mirada owners we surveyed told us that its sheer good looks sold them on the car.

And after living with it for a while, 72.1 percent still listed appearance as the Mirada's best-liked feature.

A restaurant manager from Texas put it this way: "I initially went into the Dodge dealership to buy a new truck. When I saw the Mirada, though, it just took my breath away! The car's styling and roominess sealed the deal. The only regret I have is that I didn't buy a second Mirada for my wife. She's always taking mine!"

An Ohio computer operator rhapsodized, "I love the styling and am constant-



And praise for the Mirada's clean, brawny styling goes on and on.

"Sporty looking and sporty handling," wrote a Michigan boat builder.

A Wisconsin assembler: "I've always driven Chevrolets, but I liked the Mirada's styling much better than anything GM has to offer."

And an Illinois retiree with memories of that classic look: "I like everything about the Mirada's appearance, especially the Cord-like front-end design and the beautiful upholstery."

"It's a very classy car," penned an Ohio X-ray technologist. "I bought my Mirada for its style. I consider it one of the best-designed cars of the 1980 model year."

A 19-year-old female factory worker from Michigan confided, "Girls always

buy a car first for looks, then for things like comfort, gas mileage and so on."

A North Carolina company manager summed it up this way: "We needed a larger car, liked the Mirada's appearance, and felt we could get the best price from Chrysler because of its financial problems."

We noted an undercurrent of concern for Chrysler's business difficulties in many of the responses we received. A Pennsylvania administrative sales manager, for example, told us, "I bought my Mirada primarily on the basis of looks, but I also like Mr. Iacocca's style on television. He helped me decide to purchase my first Chrysler product since 1953."

And a Michigan electronics technician echoed: "I was impressed with the TV ads—Lee Iacocca puts forth a very sincere image."



Chrysler designers acknowledge coffin-nose Cord's influence on Mirada's grille.

ly being bombarded with comments and questions about the car. It's incredible how many compliments I've received on my Mirada! From people I know to people I don't know, it's nothing but praise."



The luxurious car interior can be ordered with leather upholstery and a console.

BY MICHAEL LAMM WEST COAST EDITOR

## Owners heap praise on the Mirada; its only fault seems to be poor mpg



Slant Six delivers best economy, owners say.

Last year's Magnum had same Cord-like face as the Mirada.

Suspension and basic chassis come from MoPar's J-body.



The restaurant manager, mentioned earlier, adds, "I have only praise for Dodge and Chrysler Corp. This car can help a troubled company. I looked at many different cars (T-Bird, Cougar, Grand Prix, Regal) but picked the Mirada and don't regret it one bit."

Some of the old Dodge virtues still shine through. For example, a Michigan truck driver volunteered, "I still like

Chrysler engineering," and an Arizona telephone man said, "I went back to Dodge because we needed dependable transportation."

But most owners praised the Mirada's specific virtues: styling, handling, comfort, ride and economy. The following are random, but typical, praises.

"The comfort of the Mirada cannot be exceeded by any cars of its size."—Indiana printing rep.

A Michigan department supervisor: "It's a very distinctive-looking car, gets fairly decent gas mileage, and the Mirada's price was within reach. My company buys new General Motors cars every year. In seven years, I've yet to see one delivered in perfect condition. But the Mirada has been so troublefree that, in the 4200 miles I've owned it so far, I haven't once had to open the hood."

Mechanically, the Mirada turns out to be one of the least troublesome American cars we've reported on lately. Fully 62.2 percent of the owners we surveyed said they'd had no mechanical problems of any sort. That's nearly 10 percentage points better than the Cadillac Seville, 17 points better than the Olds Toronado, and 19 points above the Omni-Horizon.

Dealer service garnered equally good reviews, with 70.7 percent deeming service satisfactory when needed and 72.2 percent rating their service staffs good to

*(Please turn to page 150)*

## The mod Mirada

As youth goes, so goes the market. That's been a product planner's maxim dating back to 1955.

Today, as more and more young buyers slide into smaller and smaller economy cars, customers for big cars grow progressively older. It's a trend that Detroit—and especially Chrysler Corp.—wants to counter, at least for the next few seasons or until it, too, can produce smaller cars.

The Mirada's planning period predates \$1-a-gallon gasoline, so in some ways the car is an anachronism.

Yet Dodge finds it advantageous because the Mirada provides a flashy, larger model that sparkles with youth appeal. Very simply, Dodge wants to keep young buyers interested in this size category. Chrysler, after all, still manufacture a lot of cars with these dimensions.

As it turns out, nearly 55 percent of those owners we surveyed are under age 40—so the car seems to be doing its job.

The Mirada, identical to the Chrysler Cordoba in all but cosmetics, uses basically the same chassis and suspension introduced in the 1976 Aspen and Volare sedans. These underpinnings currently also support the Dodge Diplomat and Chrysler LeBaron.

So, while corporate designers have done a fine job of making the Mirada look new, all its mechanical components are tried and proven, including its three engines: the veteran Slant Six, the reliable 318 V8, and one of the industry's biggest remaining powerplants, the MoPar 360 V8.



Plenty of legroom in rear seat, owners tell us, plus easy entry via long doors.

## A NATIONWIDE SURVEY BASED ON 476,456 OWNER-DRIVEN MILES

Plenty of headroom is achieved despite low overall vehicle height.

Large, squared-off trunk offers lots of luggage space despite intruding spare. Some owners objected to "corny" rectangular taillamps, said they don't go with rest of the Mirada's design.

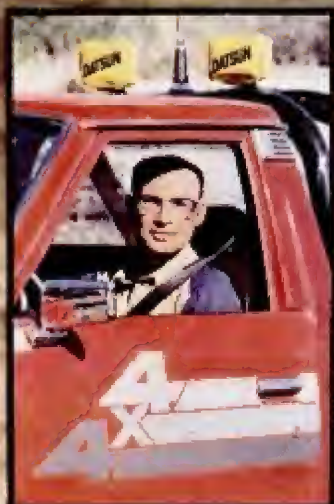
Rear panes ought to open outward for ventilation, suggest owners.

Mirada shares 112.7-inch wheelbase with Aspen/Volare/LeBaron/Diplomat.





# Bashing through Baja



The Datsun longbed version (above) has payload rating of 1400 pounds. The rear tow hook is available as an option. Ground clearance (left) is a generous 8.8 inches, providing plenty of room for the serious off-roader. Accessories such as a push bar and auxiliary lights can be ordered from Datsun dealers. Hard as he tried, driver couldn't drown the engine (bottom left).



PM photos by the author

by Michael Lamm • WEST COAST EDITOR

**I**f it's off-roading you're after, the new Datsun 4x4 mini-pickup bounces your buns with the best. I don't believe there's a more rugged truck built in any size.

Datsun invited four dozen automotive journalists to try to destroy 14 production 4x4s in the spiny mountains of central Baja California. We tried but



# in Datsun's new 4x4



The 1.9-liter, overhead-cam, four-cylinder engine produces 92 hp. Dash includes a tach, voltmeter and oil-pressure gauge.



failed—failed even to drown out an engine or to bring squeaks to any of the cabs.

Datsun flew us in three twin-engined Cessnas to the tiny village of Valle de Trinidad. We knew we were off on an adventure when one of the planes crashed on landing. Fortunately, nothing got hurt except the pilot's career and the belly of the Cessna it-

self (the pilot simply forgot to lower the landing gear).

From Valle de Trinidad we drove the Datsun 4x4s some 20 miles to Mike's Sky Ranch, 4500 feet above sea level. The climb took 1½ hours. The road consisted mostly of ruts and was liberally decorated with washes and boulders. Baja's big spring

*(Please turn to page 170)*







# BICYCLE COMMUTING

## It makes more sense than ever

The logical response to both the gas crunch and the fitness boom, commuting by bicycle is fun and saves money.

by Tom Sahagian

**B**ike commuting is becoming increasingly popular—there are a half-million commuters nationwide, according to Department of Transportation Secretary Neil Goldschmidt—and many more people will be discovering good reasons to ride to work.

In many ways, the bicycle is the ideal commuting vehicle. Nonpolluting, energy-efficient (more so than any other form of transportation), inexpensive and just plain fun, the bicycle could eliminate the crowding, noise and fumes of our auto-clogged streets. The frustration and anxiety that characterize most auto commuting would be replaced by smooth, healthful cycling.

Consider the advantages. Like a car, a bike is not subject to the rigid scheduling (or unreliability) of mass transit. But unlike a car, it can go almost anywhere, can't run out of fuel and never needs to warm up. Even an expensive bicycle is cheap compared to the smallest car. Most people could buy an exotic new bike every year with the money they spend on car insurance alone. And maintenance? All thoughts to the contrary, bikes are easy to maintain and repair, and hardly ever break anyway. Next time you're lying on your back with grease in your face under a precariously jacked-up car, think about that.

And don't forget fitness. Cycling is

The sign tells the story—the bicycle is the commuting vehicle of the future. Below, four ways to make commuting easier:

1. Slip-on shoe covers keep feet dry, warm in bad weather.
2. Leg strap keeps pants away from chain.
3. Lightweight rain chaps hang from belt.
4. Panniers provide greater carrying capacity than backpacks, handlebar bags.







PM photos: Brad Hess

a great way to get into shape.

Not only does bike commuting make more sense than ever, it's easier than ever, too, thanks to developments in bikes and accessories.

Bicycles themselves have not changed much, and, as is pointed out later, commuters use all types. Some innovative folding machines make taking a bike on a train or bus easier, but now large carrying bags are available for transporting 10-speeds. Just flip the quick-release le-

vers, remove the wheels and pop the bike into the bag.

Bike equipment *has* changed, though, and for the better. High-pressure (100-p.s.i.) tires are now available for the most common type of wheel rims and the rims themselves are lighter. The result is a smoother, easier, more efficient ride, although some experts claim the tires are easier to puncture.

That brings up the great fear of many an almost-commuter: flat

tires. Although flats are not really the problem most people think, several tire inserts and airless tires are now on the market, and most of them do eliminate flats. But almost all are flawed in some important way. It's probably easier to carry a spare tube for the few flats that occur. It's likely, though, that manufacturers will soon produce a more widely-accepted product.

In order to carry a spare tube,

[\(Please turn to page 146\)](#)



AS A WARM-WEATHER SPECTACLE  
AT AIRPORTS ALL ACROSS THE UNITED STATES...

# WORLD WAR II IN THE AIR IS ALIVE AND WELL

by Robin Nelson

**S**tanding 100 yards from the runway with the rest of the crowd as the P-51s come across low and hot, you are suddenly amazed by the noise. You tend to forget how those Packard-Merlins sounded when they were wound up. But the growl and whine of airborne piston engines is the one thing that confirms that you're back there—back in World War II—and when a lone Mustang returns

even hotter and pulls up into a victory roll the crowd goes "aaahhh" and the goose pimples break out even on kids who have only ever seen it before in the movies.

Observers of popular culture are only guessing as to why, but it seems that as we approach the 40-year cycle on the anniversaries of major World War II events, both nostalgia and serious interest are peaking. And

on the local airport airshow circuit, promoters—including charity fund raisers in many instances—are finding out that "warbirds" will pull in the crowds as never before.

Warbirds of America, Inc., affiliated with the Experimental Aircraft Assn. and headquartered in Hales Corners, Wis., is an umbrella organization of World War II aircraft owners and buffs. Not all of its







Large photo: A flight of four P-51 fighters approaches the Ti-Co Airport near Cocoa, Fla., to participate in an airshow with the only war-vintage Junkers 52 still intact. Below are a P-51 (far left) and a B-25 Mitchell bomber in desert paint with its "authentic" World War II mascot emblem, both of which participated in the Ti-Co airshow. All of these aircraft are maintained and flown by private owners.







Author Martin Caidin's unique JU-52 shown at TI-Co Airport with bicentennial colors flying (in 1980). A 50-year-old design, the plane's STOL performance, rugged simplicity and mechanical attributes still add up to an "advanced" flying package in terms of modern aircraft. Sketch below is one of several wartime configurations.



## IRON ANNIE: THE 'ENEMY' STEALS THE SHOW

**T**wo miles out from the runway, the *Luftwaffe* formation circles—two graceful single-engine Messerschmitts and a massive assembly of corrugated metal slabs towed by three engines and known as a Junkers-52—called *Tante* ("Auntie") *Ju* by wartime friends and, not quite as affectionately, "Iron Annie" by wartime enemies. But as she roars across the runway now in her long-awaited attack, Annie has no real enemies—the ground-triggered "bomb" blasts are from gasoline-filled milk containers—although the crowd already suspects that the orbiting swarm of Mustangs will bounce Annie and exact revenge on her next pass. They're right—the Messerschmitts are dispersed and Annie is savaged by the 'Stangs. White smoke pours from her two wing-mounted engines—vegetable oil pumped into hot exhaust stacks.

It's all in a day's play for Iron Annie and

the man who resuscitated her, Martin Caidin. One of the country's most prolific writers of aerospace fact and fiction, Caidin recently produced a book on his love affair with this only remaining wartime JU-52 (*The Saga of Iron Annie*; Doubleday) in which he documents her history as a Norwegian airliner, confiscated *Luftwaffe* transport—in which Adolf Hitler himself was airlifted, Ecuadorian roustabout cargo ship and, finally, derelict.

Additionally, Caidin will expound for hours on the airplane's virtues to anyone falling within epithet range. And most of it is true. I sat beside him in the right seat for a patented Iron Annie takeoff. Caidin jockeyed the throttles forward and the plane's huge tail lifted off the runway before we'd gone 2 feet. It seemed to me that we began to get unstuck at about 65 mph indicated—Caidin later said it was within 400 feet of where the roll began and I know it was less than 500. With about 75 mph showing we had enough ground clearance to put a wing down and roll into the tightest turn off a runway I ever want to see, much less fly. The JU-52 easily made a 180° turn, still accelerating, without getting farther than 1000 feet from where the brakes were released on the ground.

Conceived by Hugo Junkers and Kurt

Weil in 1929, the 52 was a huge commercial success before the first DC-3 ever flew. Unique—probably to this day—was the plane's rugged reliability as an airliner, in particular one that could take off, fully loaded, with one engine out. Its independence from ground services and return on investment because of minimal downtime—rather than any striking payload figures—were the keys to its success.

As a military aircraft, the 52's versatility and unbreakability made up for some inherent unsuitabilities—chief among which was the lack of self-sealing fuel tanks. German aircrews under tracer fire paid dearly and often for this discrepancy. While the nominal military load in transport configuration was 32 troops, it is documented that one JU-52 fled Stalingrad with 59 aboard, including one clinging—ultimately frozen—to the vertical stabilizer.

The usually ebullient but often exacting Caidin was instrumental in establishing the Confederate Air Force spin-off group in Florida known as the Valiant Air Command, and has been flying Iron Annie in shows where the VAC participates. Recently, he spoke of starting a new organization to be known as the Rebel Air Circus. Wherever Annie goes, however, and under whatever flag, she's a treat to see.—R.N.



As PM's Robin Nelson found out, the JU-52's dorsal gun turret is a great place for warbird watching. Ray Martin's ME-208 (right), the only one still flying, is also seen above off the Junkers tail as the Axis formation "attacks."





1300 members own or fly airplanes, and some are partners in shared warbirds—some own more than one. Jim McDonnell, a newspaperman long associated with the group, estimates that about 300 World War II aircraft are actively flown today.

"Buffs were always interested in restoring World War II planes," says McDonnell, "but sometime in the Seventies—maybe it had something to do with the Bicentennial—the public began to show a lot more interest in seeing them fly."

Which didn't bother the buffs one bit. One of the few things that defray the exorbitant costs of maintaining and flying a 40-year-old military airplane are airport operators who offer free fuel—a major inducement—to owners who agree to show up and fly an airshow routine. There are also some Internal Revenue Service wrinkles that apply to restored aircraft, but often planes are "donated" by individual owners to a co-operative group like the Confederate Air Force (CAF), which until recently was unique and pioneered the World War II airshow circuit. Former owners then get to fly the birds in the CAF Ghost Squadron's reenactments of Big War encounters. (At one point this included a B-29's simulated A-bomb run over Japan, but public outcry removed it from the agenda.)

CAF is headquartered in Harlingen, Tex., and flies its own big air show there each year in October (see calendar below). CAF has active "wings" in other states, but two years ago its Florida wing decided to become autonomous under the name Valiant Air Command. VAC members retain their own planes; the only things pooled are effort—to put on their own annual airshow at Ti-Co airport near Cocoa, Fla.—plus experience and expertise. Maintenance and parts problems continually haunt warbird owners. If a plane is one-of-a-kind or very rare, replacement parts may have to be fabricated from scratch—and even flight manuals may be nonexistent, making just starting an engine for the first time an adventure in itself.

When the mechanic who does most



Walk-around time is almost as good as the flying display. Above, an ME-108 flown by father/son team of Lee and Carl Dufrechou shares the ramp with an SNJ and other birds.

of the work on the CAF's B-17 Flying Fortress was transferred last year by the airline that employs him full time, the old bomber was moved to his new base right along with him—so critical is knowledgeable maintenance.

The big bombers are rare spectacles even in the newly enlivened skies of World War II remembered; there are only a couple of B-17s and just one B-24 Liberator currently on flying status—with overall expense, complexity and fuel capacity providing easy reasons why. The AT6 trainer (SNJ to Navy types) on the other hand, of which more than 17,000 were built in the U.S., is always present in handfuls where warbirds turn out—partly because of its simplicity and parts availability but also because it is, as it always was, a good airplane in which to get started flying World War II.

But by far the most popular aircraft among warbird pilots and spectators alike is the P-51 Mustang. Many authorities believe it was the consummate fighter of World War II, and it flew on even into Korea. A 'Stang holds the current world piston-powered speed record, at a fraction under 500 mph, and another has the cross-country record of six hours, 21 minutes, for Los Angeles

to Washington, D.C. Among 'Stang buffs, the coup is to spot rare "C" (prebubble canopy) or "H" (hottest of the hot) models.

You could have purchased a P-51 from a government surplus depot in 1946 for about \$3500. The asking price for a "clean" one today often exceeds \$200,000. Next to that, gold is a bum investment.

One of the best parts of a warbird show comes before the flying display, when the birds are parked for close-up inspection. "When a plane is taken down and rebuilt, bolt by bolt, then finished with today's paints in an authentic color scheme, it's a far more beautiful thing than ever came off the line in 1942," says Jim McDonnell.

Inevitably, the trivia nuts dominate the walk-around inspection conversation, dropping such gems as how the Zero got its name,<sup>1</sup> which frontline U.S. fighter was originally designed for the Royal Air Force (RAF)<sup>2</sup> or how the first ME-262 jet got off the ground<sup>3</sup>. Maybe you've heard it all before, but it's still a kick to stand in the shade of a wing and go through it again.

Sure, war is hell, the pilots say, and it always will be. But these machines are somethin' else. **PM**

## WHERE TO SEE WORLD WAR II AIRPLANES FLYING THIS YEAR

**June 7-8:** London Intl. Air Show, London, Ont.  
**June 21-22:** Hamilton Intl. Air Show, Mount Hope, Ont.  
**June 28-29:** Blue Grass Air Show, Lexington, Ky.  
**July 1:** Summerfest (air show), Milwaukee  
**July 12-13:** Blue Angels Homecoming Show, Pensacola Naval Air Station, Pensacola, Fla.  
**July 19-20:** Dayton Air Fair, Dayton, Ohio  
**July 26-27:** Park District Air Show, Chicago  
**July 27:** Air show and display, Thiel River Falls, Minn.

**Aug. 2-9:** Experimental Aircraft Assn. fly-in, Oshkosh, Wis.  
**Aug. 9-10:** Detroit City Air Show, Detroit  
**Aug. 15-17:** Warbird Air Show, Ogden, Utah  
**Aug. 24:** Grider Field Air Show, Pine Bluff, Ark.  
**Aug. 30-31:** Cleveland National Air Show, Cleveland  
**Sept. 1:** National Air Festival, San Diego  
**Sept. 6-7:** Metro Airport show, Nashville, Tenn.  
**Oct. 9-12:** Confederate Air Force Show, Harlingen, Tex.

<sup>1</sup>Formally, it was designated A6M, indicating the sixth carrier aircraft designed for the Japanese Navy from Mitsubishi Co. The production model came out in the Japanese calendar year 2000 (1940) and was given the customary sea (type) number based on the last two digits of the initial production year. Hence, the A6M, Zero-seen fighter.

<sup>2</sup>The P-51, North American Aviation undertook all design and development costs without government help based on an original RAF order for 350 aircraft. Only after it saw the prototype fly did the U.S. Army Air Corps show any interest.

<sup>3</sup>Through either sheer genius or cool ingenuity: Barreling down the runway in the first all-jet ME 262 (previous models had flown with an auxiliary piston engine), test pilot Fritz Wendel got absolutely no elevator response so he hit the brakes! This brought the tail up momentarily, the control surfaces became active and the plane flew without further incident. The maneuver became S.O.P.



**L**ook around. Where else will you find a car that's going on 40 and still a teaser?

The Jeep sells mostly to young people—what Detroit calls the youth market. Nearly 90 percent of the owners in our survey weren't even born when the first American Bantam Jeep bounced across the mock battlefields of Camp Holabird, Md., in the fall of 1940.

Jeeping continues to be a state of mind. The Jeep became a cult car long before anyone dreamed up that concept. Not a nut nor bolt interchanges with the original, yet the 1980 American Motors Jeep remains an original. It's still the True Jeep, a direct descendant of Willie the Willys—oft copied and never matched.



Jeep owners praise open-air driving and the rock-solid construction of both models.

## PM OWNERS REPORT: JEEP CJ-5, CJ-7

What we have here is the stuff of legend: veteran of three major wars, butt of countless jokes, hero of battles real and imagined. It's a vehicle that's just as serene accepting the Museum of Modern Art's award as one of the world's 10 all-time best automotive designs, as it is on the sands of Iwo Jima and North Africa.

We're dealing with a phenomenon beyond reason. The Jeep remains a workhorse, yes, but it's also a toy and an instrument of the owner's self-image. As it has been for almost 40 years, it's an imperfect, sometimes aggravating car that's always forgiven for one simple reason: It's fun to drive!

Jeep owners tend to be individualists. They're hard to pigeonhole, and for that reason, this Owners Report will deviate

slightly from our usual format. Instead of categorizing responses as we usually do, let's examine the comments of several diverse, but typical, Jeep owners.

First, here's a 22-year-old mechanic/electrician from Illinois. He drives a four-cylinder CJ-5 with four-speed.

"I buy new cars every year," he told us, "and found this AMC dealer tough on price. I had to be persistent and spent a lot of time dealing. I was presold on four-wheel drive from last winter's snows. I drive 24 miles to work and don't want to get stuck. Driving to and from my job is a top priority.

"So far, I've had only two mechanical problems with my CJ. The pin holding the shift lever onto the transfer case sheared off, and the speedometer cable broke. I replaced the broken pin myself; the dealer fixed the cable. I rate his service department as excellent. AMC mechanics give speedy, courteous service.

"I'd rate the Jeep's workmanship as good. For this day and age, I think it's pretty well constructed. But, as with all things, materials seem to get cheaper as prices go up. What I really wish they'd change, though, are the front lock-out hubs. It's a pain to have to stop, get out, and lock/unlock them everytime I switch into or out of 4wd.

"My specific praises of the Jeep include its 20/26-mpg gas mileage with the Four, its maneuverability, tall ride and control in

BY MICHAEL LAMM WEST COAST EDITOR

## Jeep lives up to its rugged reputation, although owners would like better mileage



Owners would like a lockable compartment in the rear.

Stiff rear springs don't bottom out in the rough.



snow and rain. The only thing I don't like about it is the feel of the power steering with the Goodyear Tracker A-T tires."

Next, here's a Florida production-flow manager, aged 23, who drives a CJ-7 with the 258-cu.-in. Six and four-speed.

"We own property in the North Carolina mountains, and I haul my boat and like 4wd for trailering. One thing I especially like is that it's a simple vehicle. I can hose down the entire interior, including the instrument panel, after it gets muddy or dirty."

"Mechanical problems have involved



The no-frills interior provides drivers with adequate comfort and lots of legroom.

loose heater wires, a small leak at one front hub, and a broken clutch-return spring. All repairs were made quickly, and the dealer took time to explain why the

parts failed. Because of my working hours, this dealer also made special arrangements to allow me to drop off my Jeep after regular hours. All charges were covered by AMC's warranty.

"I shopped two different dealers. The first one was high-pressure and high-priced, but the second allowed me a full \$1000 discount and spent a lot of time showing me different models and features. I find workmanship excellent. The car takes a helluva beating and keeps going."

"I'm over six feet tall, yet have lots of legroom. It's an excellent-handling vehicle, with great versatility, very sturdy, good view of the road because of height. I get an open and free feeling with the top down. To me, Jeeps have classy lines. Nothing else looks like a Jeep. I definitely intend to buy another Jeep when this one wears out, but that'll be a long time, I'm sure."

Now to a California electronics engineer, aged 23, with a four-speed, six-cylinder CJ-5:

"I bought this Jeep for rough four-wheeling. What I especially like about it is its ruggedness. The thing goes like a mule. Also, it's simple. The only thing I don't like is the gas mileage. I'm getting 12 to 16 mpg.

"The dealer replaced a broken drive-shaft and mended a noisy clutch throwout

(Please turn to page 168)

## Jeep: a living legend

Jeep again offers a four-cylinder engine. It's Pontiac's "Iron Duke," a 2.5-liter pushrod design that also powers GM's X-cars.

The Four is spunky, yet gives owners the option of fuel economy in the 20-mpg range. Additional Jeep engine choices include AMC's long-lived 258-cu.-in. Six and the 304 V8. Owners of Jeeps with these engines had more complaints about fuel mileage.

Jeeps come in two basic sizes: the CJ-5 on an 83.5-inch wheelbase, and the CJ-7 with a 10-inch-longer chassis. AMC offers three equipment/trim packages for both Jeeps: the Renegade, the Golden Eagle and the Laredo. All of them include upgraded tires and wheels, specific interiors and urethane wheel-lip moldings.

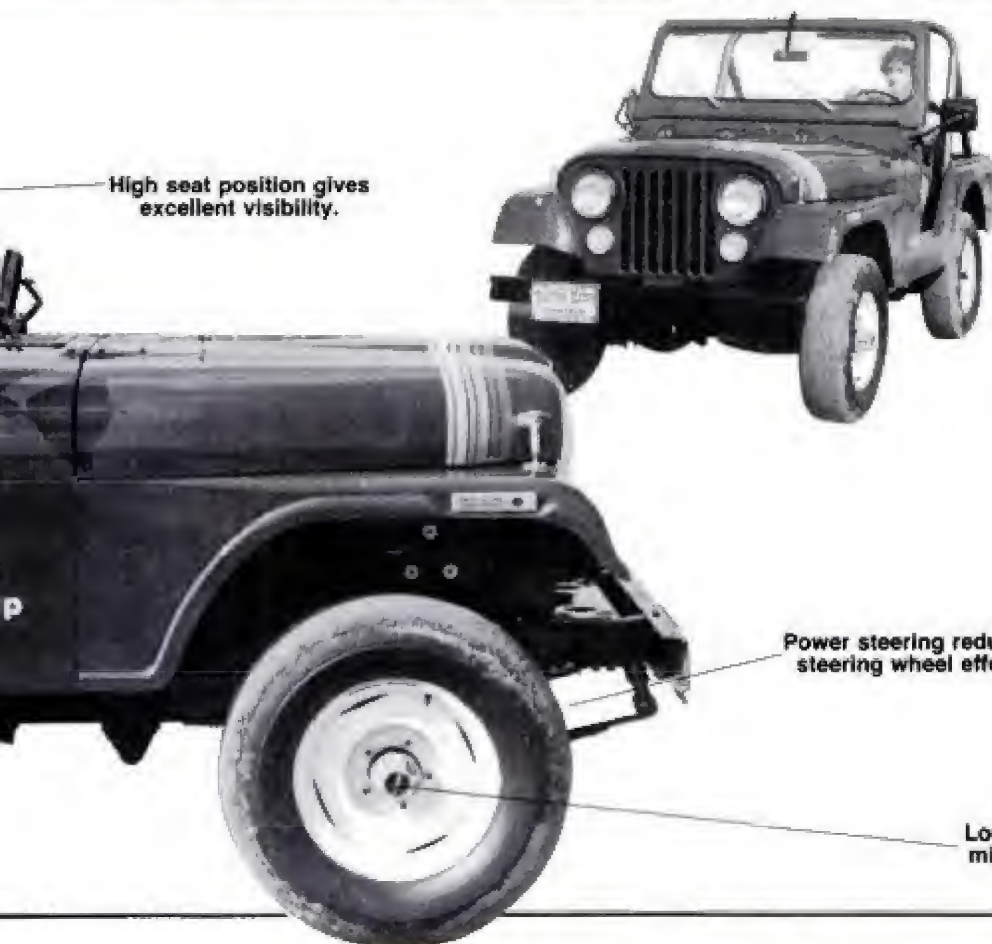
All Jeeps come with a folding windshield, rollbar, front disc brakes and the new four-speed transmission. Options include an automatic (except CJ-5) and part-time 4wd with automatic transmissions.

When you buy a new Jeep, you buy it topless. For the CJ-5, the factory offers a vinyl or denim soft top. Soft tops are now available with steel doors and roll-up windows. The CJ-7 can be had with a molded hardtop for 1980.

In addition to the CJ series, the full line of Jeeps also includes the J-10 pickups, plus the two-door Cherokee Wagon and the four-door Wagoneer.

For the first time in seven years, the Wagoneer will be available with either the full-time or part-time Quadra-Trac transmission, improving fuel economy considerably.

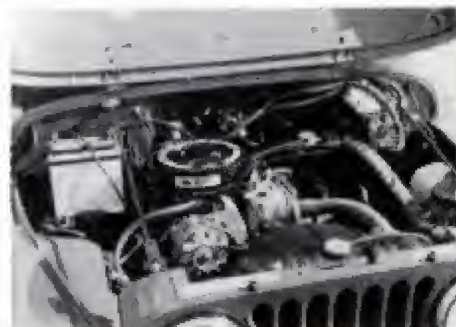
A NATIONWIDE SURVEY BASED ON 771,465 OWNER-DRIVEN MILES



High seat position gives excellent visibility.

Power steering reduces steering wheel effort.

Locking hubs increase mileage on pavement.



The Pontiac-built, four-cylinder engine yields 20 mpg on the highway and 17 in city driving. Still, most buyers opted for the six-cylinder engine, which gives 17 mpg on the highway, and the V8, which averages only 15 mpg.



# Great ways to use airy, elegant lattice



Cool and refreshing patio enclosure adds privacy to outdoor living area without sacrificing fresh air and sunlight.

## 1 Deck enclosure with arched windows

by Joseph R. Provey  
ASSISTANT HOME AND SHOP EDITOR

**F**or many people, latticework brings to mind garden trellises, bowers and summer cottages. It is commonly used to support climbing vines—or to screen unsightly footings. Architects and designers recognize that these simple patterned screens have decorative as well as functional applications.

The deck enclosure with lattice-work walls on this page is a good example. It's built of redwood and finished with a clear, water-repellent finish (with mildewcide) to maintain a mellow redwood color.

The latticework screens provide privacy for meals and parties. They are made of 1×2 boards for stability, but nominal 2-in. stock, ripped to ¾-in.-thick strips, saves money.

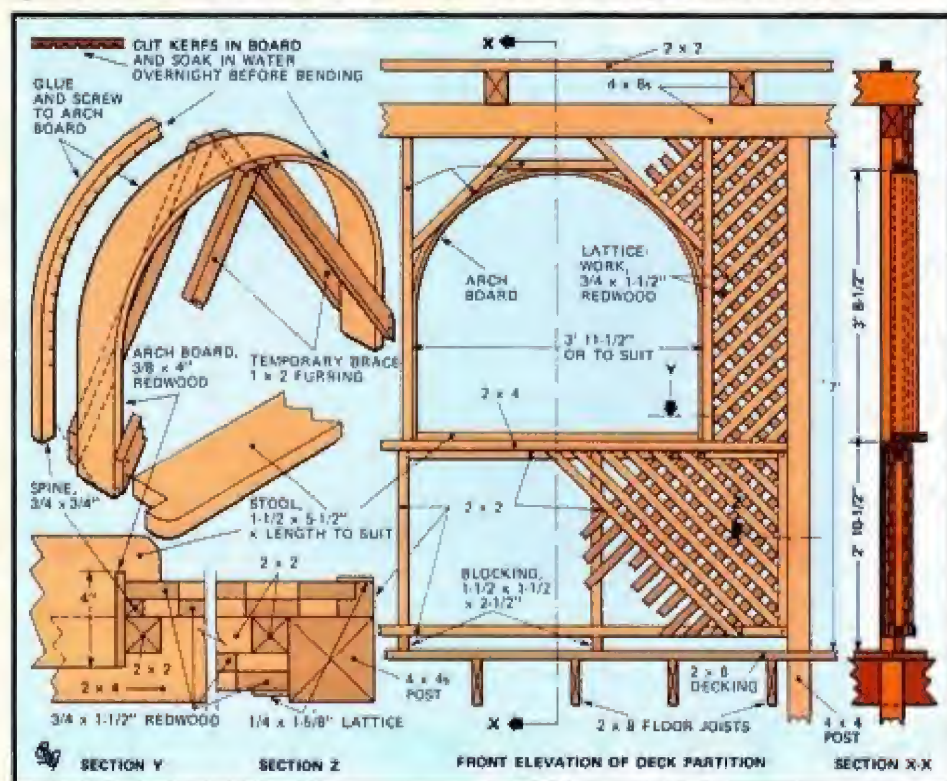
The enclosure frame consists of posts and beams. Run posts through the deck to concrete piers and drift pins below, or fasten them to decking with angle fasteners (over a supporting member). Use 2×2s to frame openings between posts, and nail latticework to them.

To bend a 116-in.-long arch board

(clear redwood) for the 47½-in.-wide window shown, cut ⅝-in.-wide kerfs, ¼ in. deep and spaced 1 in. on center. To bend the 118-in.-long spine, cut ⅝-in. kerfs, ⅝ in. deep

and spaced ⅝ in. on center. Soak boards in water until they bend without splitting.

Next, preassemble and temporarily brace the arched windows to hold the shape until they are nailed in. Kerfs can be left exposed or filled with white glue and sawdust.







## 2 Window shutters and wall panels

A room plagued by too much sunlight was transformed into this cheerfully dappled setting by adding lattice panels to the bare wall and matching shutters to the win-

dows. Although the diamond patterns stimulate a lot of visual activity, the setting remains cool and visually relaxing.

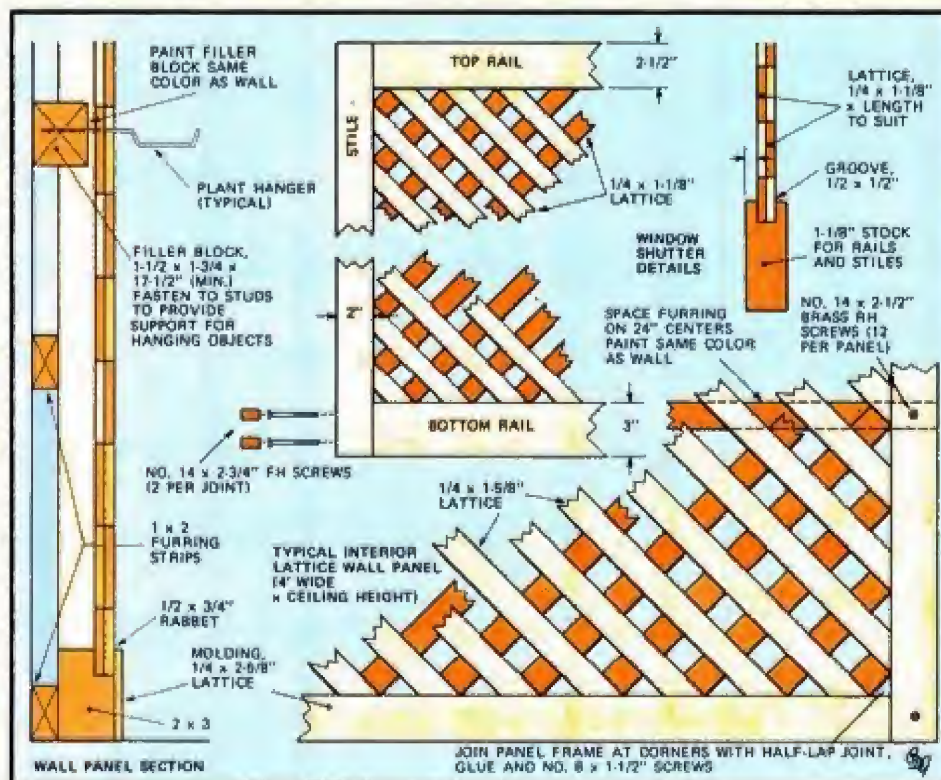
To construct the wall panels, join

Latticework shutters and modular wall panels move garden spirit into this family room. Panels remove for painting.

members at corners with half-lap joints and screws. Install bottom layer of lattice in rabbet with glue and 1-in. brads. Space the lattice 1½ in. apart at 45° to the horizontal. Since each strip is a different length, you'll have to mark and cut as you go. Cut duplicates for the top layer and for other panels you plan to make. Nail down the top layer at 90° to the first and cover with trim.

To install the modular wall panels, fasten furring strips through dry-wall or plaster to wall studs with 10d common nails. Predrill lead holes in plaster to prevent cracks caused by nailing. Fasten the lattice panels to the furring with brass screws and washers. Using screws will let you easily remove the panels when it's time to repaint them and the wall behind.

Position filler blocks behind the lattice panel to provide a secure anchor wherever heavy hanging objects (such as potted plants) are desired. Both the filler blocks and the furring strips should be painted to



Patio design for 1, Robert Gallagher; patio and bar design for 3, Steve Morgan; photos for 1 and 3, Carl Riek courtesy of the California Redwood Assn.; photos for 2 and 4, Wood Moulding & Millwork Producers.



match the wall to make them "invisible."

Simple shutters with stiles and rails grooved for the lattice may be butt-joined at the corners—or use the joint shown on page 105 for long window shutters. Preassemble the latticework with glue and trim to size on a table saw using a veneer cutting blade. Next, apply glue in the stile and rail grooves and the rail ends. Assemble and clamp until dry. Then add screws to reinforce butt joints. To hide screwheads, counterbore and dowel-plug holes.

### 3 Patio bar

**F**requent trips to the kitchen make it hard for a host to enjoy patio entertaining. A patio bar stocked with party provisions ahead of time will save you many round trips. It will also make a great place to serve buffets, as well as a counter at which meals can be eaten.

Bar construction is straightforward. Use 10d galvanized common nails to attach the sides to top cleats and the floor. Use 4d finishing nails to fasten lower cleats to the upright members and shelves to the cleats.

Allow ¼-in. gaps between top and shelf boards to prevent water standing on surfaces. Another important consideration: The top should overhang the front at least 5 in. to provide legroom when the bar is being used by a person seated on a stool.

Rip ¾-in.-thick strips from nominal 2-in. stock scrap for the latticework bar front (or use 1×2 stock and 6d nails). To assemble, fasten the horizontal strips to the vertical bar members first, using 4d galvanized finishing nails. Space them 1½ in. apart. Then nail on the outside layer with 6d galvanized finishing nails (8d nails if nominal 1-in. stock) at top and shelf level. Stiffeners may be added at the bottom, between uprights.

A color brochure on redwood garden shelters and redwood deck finishes is available for 50 cents postpaid from the California Redwood Assn., 1 Lombard St., San Francisco, Calif. 94111.

#### 3 GARDEN-GRADE REDWOODS

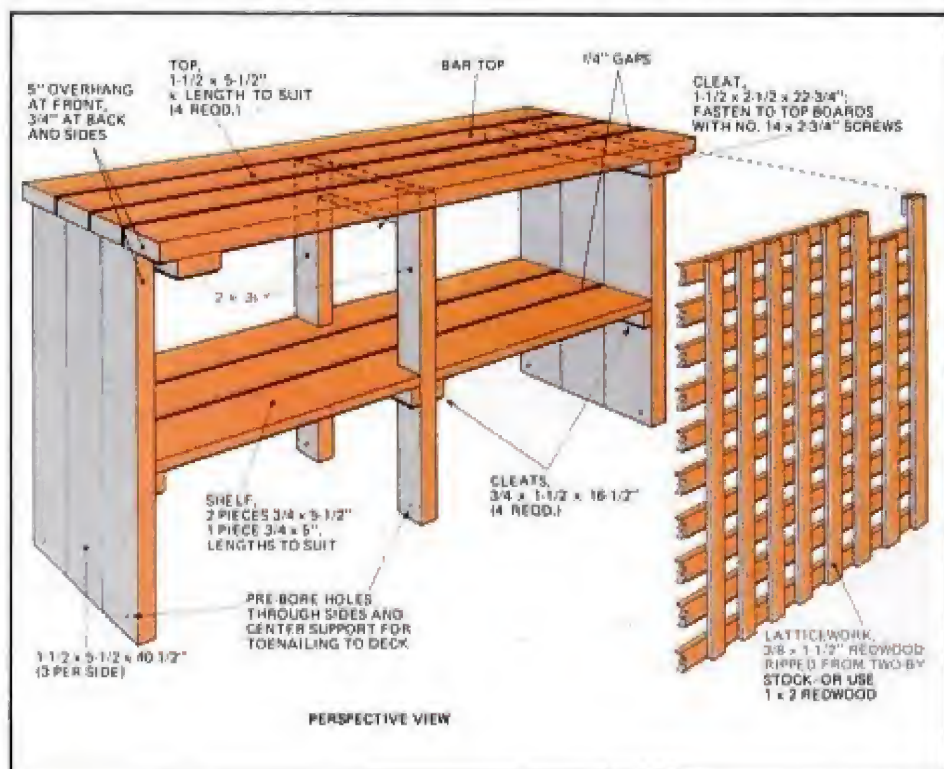
*Construction Heart* (all heartwood) is recommended for posts, joists, stringers and all near-ground applications.

*Construction Common* (contains sapwood) is good for decking, fencing, trellises, benches and trim.

*Merchantable* (has larger knots, more sap, but can be cut economically for small applications) is used mainly for planters and rails and may be ripped to provide boards for the latticework projects.



Redwood patio bar, fronted with a decorative latticework, makes this airy deck enclosure even more convenient for hosting your favorite back-yard parties and get-togethers.





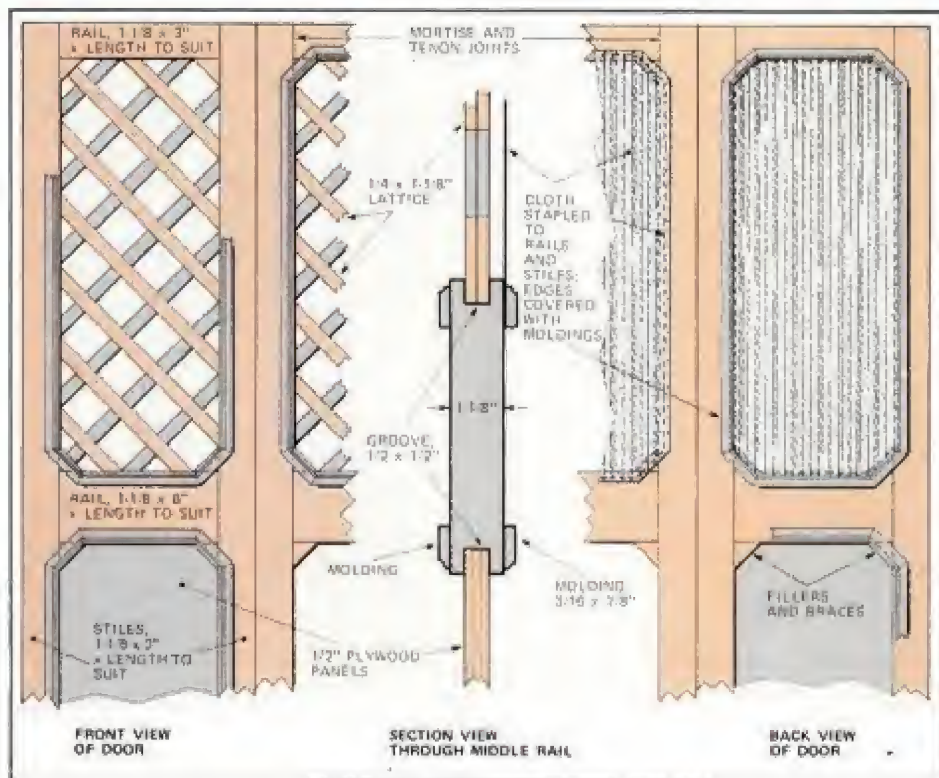
# 4 Door and window treatments

A room can look crowded if it includes too many nonunified elements. One solution is to streamline, as depicted in the vanity-closets ensemble and window screens below. This built-in eliminates a cluttered look and the diamond-lattice pattern helps to bridge visually the corners of the room.

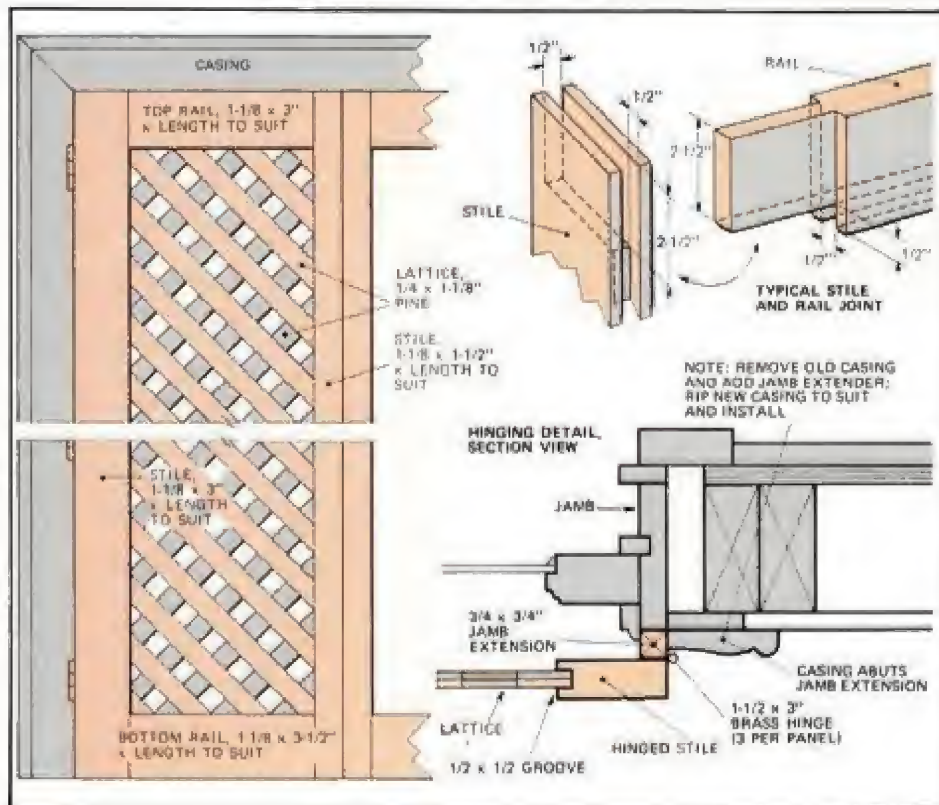
The window screens provide a con-

tinuous sweep from floor to ceiling, hiding the windows and lower wall sections; they may also be used to hide an unpleasant view.

Before assembling the closet doors, preassemble the latticework insert using  $\frac{3}{8}$ -in. staples on the unseen side. Space the lattice 3 in. apart at  $45^\circ$  to the horizontal. Then trim to size on a table saw.



For formal indoor effects, lattice was used in closet (above) and floor-to-ceiling dining-room shutters (below).



To install long shutters, a jamb extender must be used to provide clearance at the stool. The extender must be wider than shown in the plans for stools which extend more than  $\frac{3}{4}$  in. from wall.

Remove the old casing and stool horns. Then attach the jamb extender with 6d finishing nails and glue. Replace lower window stops with stop molding wide enough to cover the joint. Next, hang the shutter units using three hinges per shutter. Add new casing, abutted to the jamb extender. Choose a factory-milled molding and rip its width to suit. Or, make up your own casing with  $1 \times 3$  pine and back-band molding nailed to the outer edge for a finishing touch.

For a brochure on lattice, write to Wood Moulding & Millwork Producers, Box 25278, Dept. PM 680, Portland, Ore., 97225.

PM



# Build a cupola—the classic cooling system

Here's an attractive solution to ventilation problems in your home.

by Rosario Capotosto



PM photos by the author

Installing a cupola is an effective way of ventilating an interior, and it also adds architectural interest to your home. Our version has an eye-catching, contoured copper roof that you can fabricate in your own shop. Follow the technical drawings on page 109.

The main frame of the cupola is constructed of 2×2 kiln-dried lumber and ¾-in. fir plywood. Its base is dimensioned for a roof with a 4-in-12 slope. If your roof line differs you can alter the design to suit.

## Building the frame

Begin by cutting the vertical members (B) of the frame. Cut the four pieces to length, making the appropriate bevel angle at the bottom ends, which depends on the angle of your roof. Cut the dadoes in these members by making a series of sawkerf cuts or use a dado head.

Cut parts A with 45° miters on all ends. Assemble the square top of the frame using 8d common nails and glue. Use four bar clamps to assure squareness.

For superior holding strength and no rust stains, all nails used in the project should be hot-dipped galvanized. Use either waterproof resorcinol glue or plastic resin glue (the latter is less costly but also water-resistant).

Cut and attach crosspieces C to the verticals using glue and 3-in. (10d) finishing nails to form an H. Join the two H-ends to the remaining crosspieces. Then add the square top frame and bracing members D and G at the bottom.

## Shaping the sills

The sills (J) are of ¾-in. pine stock. Cut the 45° miter first, then notch the rear corners so they'll seat into the corner posts of the frame.

Cutting the deep bevel on the upper face of the sill is a simple task on the table saw. Face two sill pieces back to back against the rip fence; then nail a piece of plywood across both to bridge them. This allows the pieces to slide past the blade without danger. After cutting the first bevel, you rotate the pieces so you can ta-

per the second. Then glue and nail the sills in place.

To prevent rain from entering, attach stops (L and M) to the four openings at the top, bottom and sides. Bore pilot holes in the stops for the screws to attach the shutters. One pair of the shutters is hinged to allow access to the roof from the attic.

## Finishing the frame

The cupola base is sheathed with ¾-in. plywood (N and O). It is finished with Champion Building Products texture 1-11 plywood. However, you may choose to finish the base to match your house siding. Cut the siding to fit, but don't nail it in place. It must be removed later, during the cupola installation, to permit application of flashing.

## Constructing the roof

The roof base (K) is a square of ¾-in. plywood with a center cutout. The top edge is built up of 2×2s (E and F) and 1×3 sidepieces (S and T) edged with a crown molding (U.)



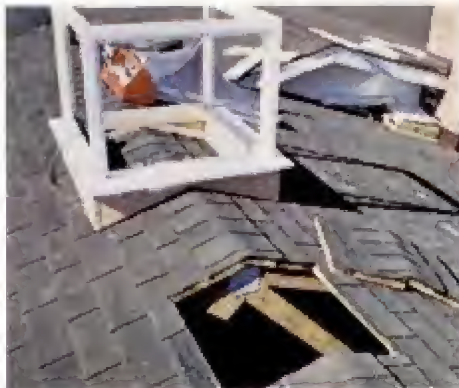
## How to top your roof with a cupola



Disassemble the cupola before moving it to the roof. It takes two people on separate ladders to carry the copper cupola roof.



After boring four corner holes from inside, mark the proposed cutout with chalk.



A coarse blade in a sabre saw makes the cut. Pack extra blades in case you hit a nail. This view shows the truss framing.



Bore angled pilot holes for lagscrews through the frame and house roof after checking for plumb. Use quality caulking to seal the angled sides of the base. The straight sides don't need caulking.



Insert flashing and the facing boards.



After securing the cupola roof, screw the shutters in place and add center cleats.

Before cutting the roofing formers (P) which give contour to the roof, you'll find it is helpful to make a cardboard template. Then cut the plywood formers on the bandsaw or with a sabre saw. Cut a top center notch in one former and a bottom center notch in the other former so they will interlock.

The top edges of the formers should be beveled 45° both sides to form a common joint for the copper roof sections. This can be a tricky operation, but you can make the bevel using a piloted bevel cutter in a router as follows.

Adjust the router so the cutter projects just enough to cut 1/8-in. short of dead center of the plywood edge. When you make the second cut on the other side, the total remaining edge will be 1/8-in. This thickness is enough to guide the pilot (or the gully between it and the blade, depending on the particular bit you use). Try a few test cuts on scrap until you get the adjustment right on target.

Cut the roof-peak support blocks

(H) from 2x4 stock, then glue and nail them in place. To align them accurately, it helps to nail a strip of wood across the face that bridges the formers.

### Fabricating the copper roof

Strips of copper (Q) can be nailed to the beveled top edge of the formers to provide a soldering base for the roofing. If you make a series of cuts along both edges of the strips you can bend them along the curved former without their buckling.

Make V-cuts with shears or make straight cuts with a jig or hacksaw. The saw kerfs will allow sufficient clearance, but simple straight cuts with shears won't provide the necessary clearance to prevent buckling.

Copper is normally sold in 3x8-ft. sheets at building material supply houses. This is more than you will need to fabricate the roof. However, if you take a full-size paper pattern of the roof section to a local roofing or sheet-metal contractor, you may be able to buy scraps the size you need.

To make an accurate pattern for the four sections (R) of the roof, trace directly over the roofing formers and make a cardboard template. Do this *before* you nail the copper strips on the top edges of the formers with 1-in. brass or copper escutcheon nails.

The four copper sections shouldn't butt tightly against one another. Instead, expose a 1/8-in. width of the copper strip below.

Use a sharp scribe against the template to mark the copper for cutting. Then cut the parts with shears.

### Soldering the roof

Soldering the roof in place is a job for a heavy-duty soldering iron. A torch isn't recommended because it is difficult to control the heat of a torch.

Apply soldering flux; then tin the copper strips (Q). Tack-solder the four roof sections in place and nail the bottom of the sections to the roof frame with 1-in. brass or copper escutcheon nails. Start soldering at



## Tips on building the cupola



Cut dado joints in vertical members (B) by making repeat, overlapping passes with saw. Note that the ends of these members are beveled to conform to the roof pitch.



Assemble with glue and nails, as well as bar clamps if possible, to assure tight joints. Use square to check that assembly is true; otherwise, shutters won't fit.



Miter-cut the ends of the sill members (45°); then saw the deep bevels on the top surfaces using the setup shown. Reverse this assembly to cut second sill bevel.



Sill ends are notched to fit around the corner posts. Apply glue to all joints before fitting them in place. The base of the frame is now ready to be sheathed.



Attach rain stops; then bore pilot holes for screws that attach shutters. Don't add them yet, but do number each section to avoid confusion during installation.



Cut the roof formers with a band or sabre saw; shape the top edges by making two passes with router fitted with a 45° bevel cutter. See text for details.



Temporarily tack-nail a strip of wood perpendicular to the peak support blocks; this helps to align the blocks for nailing.



Make saw kerfs or V-cuts in copper strips (Q) so that they won't buckle when fitted along the top edges of roofing formers.



Fold the copper strips to conform to the roof formers and nail the strips in place. These provide soldering base for roof.



Use a template and scribe to outline the cuts for the copper roof sections. Carefully make cuts with snips or power shear.

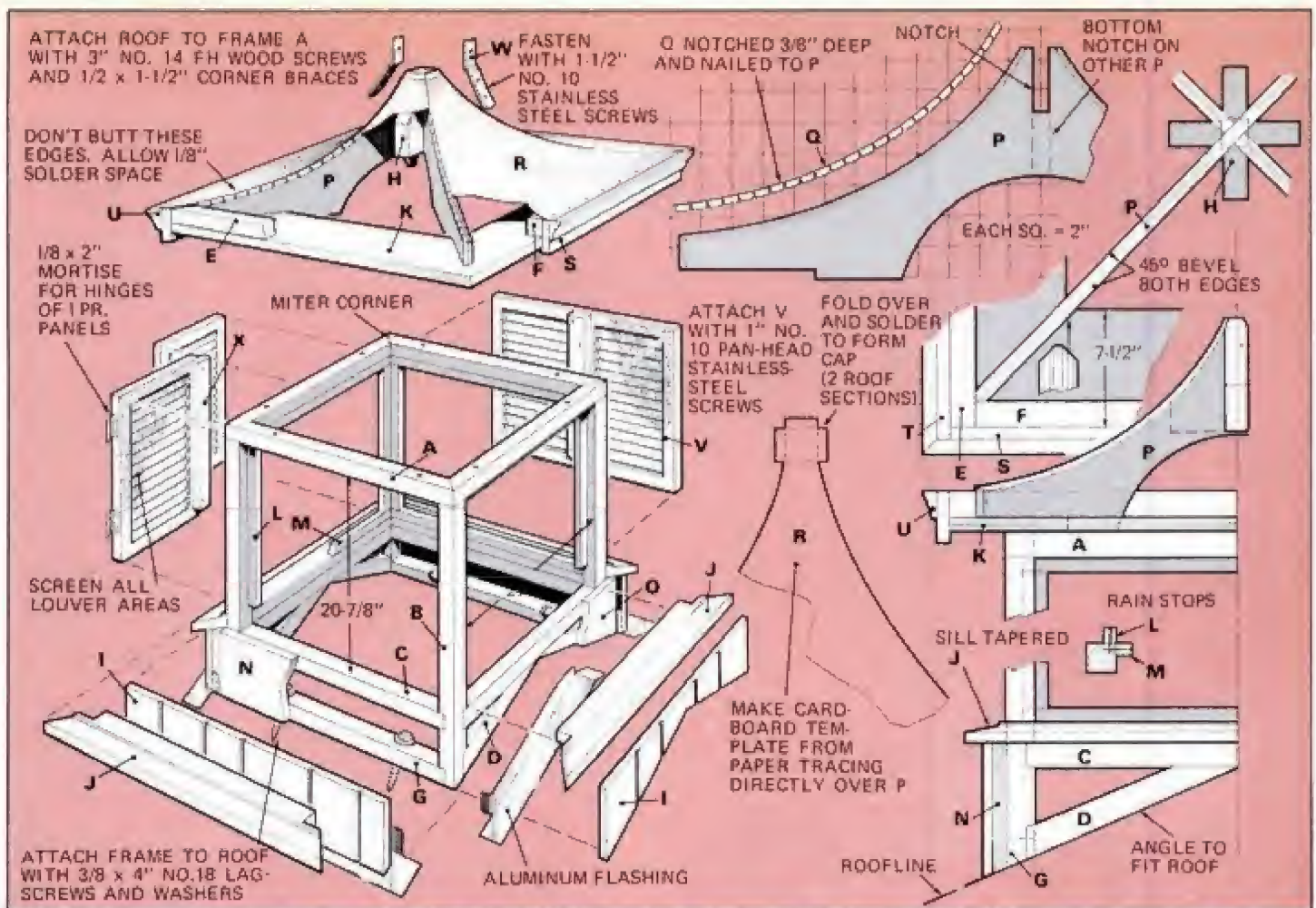


Tack-solder the copper before nailing the bottoms with 1-in. brass or copper escutcheon nails; then finish the soldering. Use a heavy-duty iron (not a torch) on the 16-oz. copper. File off solder lumps.



Weathervane bracket is made of 1/4-in. aluminum stock with stainless-steel screws.





the top of the seams and work downward using 50/50 solder.

Heat won't properly transfer

through the soldering tip if it isn't clean and tinned. As you work, continue to apply flux and solder regu-

larly to the tip to keep it tinned. Wipe off any excess solder with a

[\(Please turn to page 142\)](#)

### Other classic cupolas you can adapt to your home



The basics for building a cupola are spelled out in text and art (top), and it's relatively easy to adapt other styles, if desired. Cupolas shown above are examples that have been popular in the United States for a century. To avoid building errors, draw plans first.

Photos: Frederick Patton for House Beautiful's Colonial Homes





Pamper yourself this summer with this cotton rope hammock you can weave.

by Barbara H. Jacksier and Joseph R. Provey

**N**ot since you were a baby have you been held the way this hammock can hug and gently sway you. Made of soft, absorbent cotton cord, our unit is big enough to let you stretch out crosswise or lengthwise. Hung outdoors, the open-weave pattern permits even a slight breeze to pass through to keep you cool. Indoors, it can be hung in a living room or recreation room. When not in use, hang it on the wall.

At first, making a hammock may seem complicated. It does take patience, but weaving is a forgiving art since you can unravel mistakes and

try again. Start off setting up the hammock loom shown on page 112.

Make two braids to form the hammock edges next. For each braid, cut two 220-in. lengths. Tie one pair at their middles to a loom pole using a square knot. Begin to braid by placing the rightmost strand over the one to its left. Then place the leftmost strand over the two strands to the right. Repeat these two steps, always working the right cord over one cord to the left and the left cord over two cords to the right, until the braid is 80-in. long, including the starting loop. Now, tie the loose end of the braid to the other dowel with a square knot. Insert 16 paper clips at the ends of the braid and at 4-in. intervals. Slip it down the poles to

make room for a second braid and for weaving of the body of your hammock.

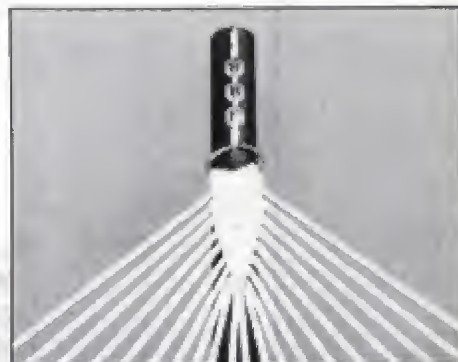
When both braids have been completed, make a plywood shuttle as shown on page 112 and wind about a third of your cord onto it. Unwind about 9 ft. and bind the cut end. Then, starting at the right-hand edge of the top braid, thread the bound end from front to back through the braid at the first paper clip. Repeat this at each clip. Tie the bound end of the cord to the left dowel under the top braid when finished.

At the right dowel, pull the cord back through the braid until it's

PM photos by Eric Barnick; hammock stand is from Hammacher Schlemmer, 145 East 57th St., New York, N.Y. 10022, and sells for \$114.50 postpaid (in continental United States)



# How to make your own hammock and hang it anywhere



Twenty-strand harness allows the hammock to conform to shape of your body.



taut. Stretch the cord to the pole top and hold it there while extending the cord down to the X-mark. This point marks the total length (89 in.) of the first and all subsequent rows of cord. To register this point, wind it around the nail at the top of the pole and prepare to weave next row by dispersing slack equally to form loops.

All of the following rows are woven using the shuttle. Bring it around the outside of the loom pole and toward you, passing under the top braid. Then push it from front to back through the first loop and each

## MATERIALS LIST—HAMMOCK

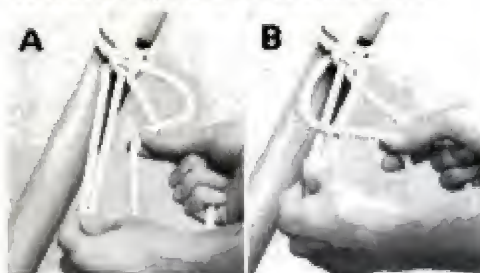
- | No.  | Size and description (use)   |
|--|--|
| 1  | $\frac{1}{2}$ " dia. $\times$ 1000' cotton cord (hammock body, edging and harnesses) |
| 2  | 1 $\times$ 1 $\times$ 60" oak (spreaders); rip and resaw from $\frac{1}{2}$ " stock  |
| 2  | 2" dia. rings, brass or cadmium-coated (harness rings)                               |
| 2  | 1 $\frac{1}{4}$ " dia. $\times$ 4' round stock (loom frame)                          |
| 1  | $\frac{1}{2}$ $\times$ 5 $\times$ 24" plywood (shuttle)                              |
| Misc. White adhesive tape or string for binding cord ends; 5, 10d common nails; 32 large paper clips |  |

remaining loop, making 15 passes in all. Pull the cord taut and once again register an 89-in. length using the X-mark. Wind it around the nail atop the second loom pole. Redisperse the slack and the second row is complete. Pass the shuttle around the dowel as before.

The first loop in the third row is formed by passing the shuttle from back to front through the leftmost loop. The end loops are easy to miss. *Be sure you make 15 passes per row.* Complete the third row, register the 89-in. length, and wind it around the nail on the loom pole after letting the first row's cord slip down over the dowel. Pass the shuttle around the dowel and repeat the instructions for weaving the second and third



## Weaving the hammock



To make the braid, place rightmost cord over cord to left (A). Then place leftmost cord over two cords to the right (B).



Repeat steps A and B until the braid is complete. Pull the strands tight to assure a strong braid that won't stretch.



Use paper clips to mark intervals and thread first row of mesh into braid. Pointed dowel opens braid for threading.



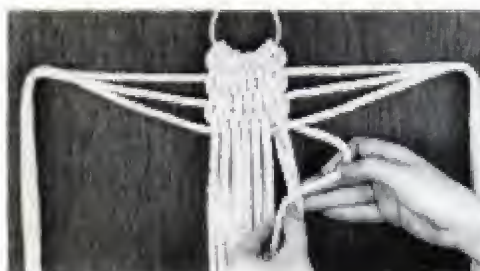
After first row is threaded and tied to left loom pole, measure length using X-mark and disperse slack to form loops.



Again, working from right to left, make the second row of mesh by passing the shuttle, front to back, through the loops.



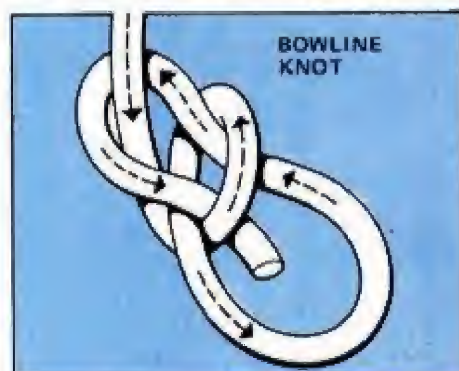
When you weave rows in opposite directions (from left to right), pass shuttle and cord back to the front through loops.



Weave the harness with the ring hanging on wall. Use a pair of nails to permit hanging woven strands out of the way.



To join hammock body to harness, tie loops of mesh, two at a time, to corresponding harness cords using a bowline (right).



rows until you have 37 loops on each dowel, not including the braid loops.

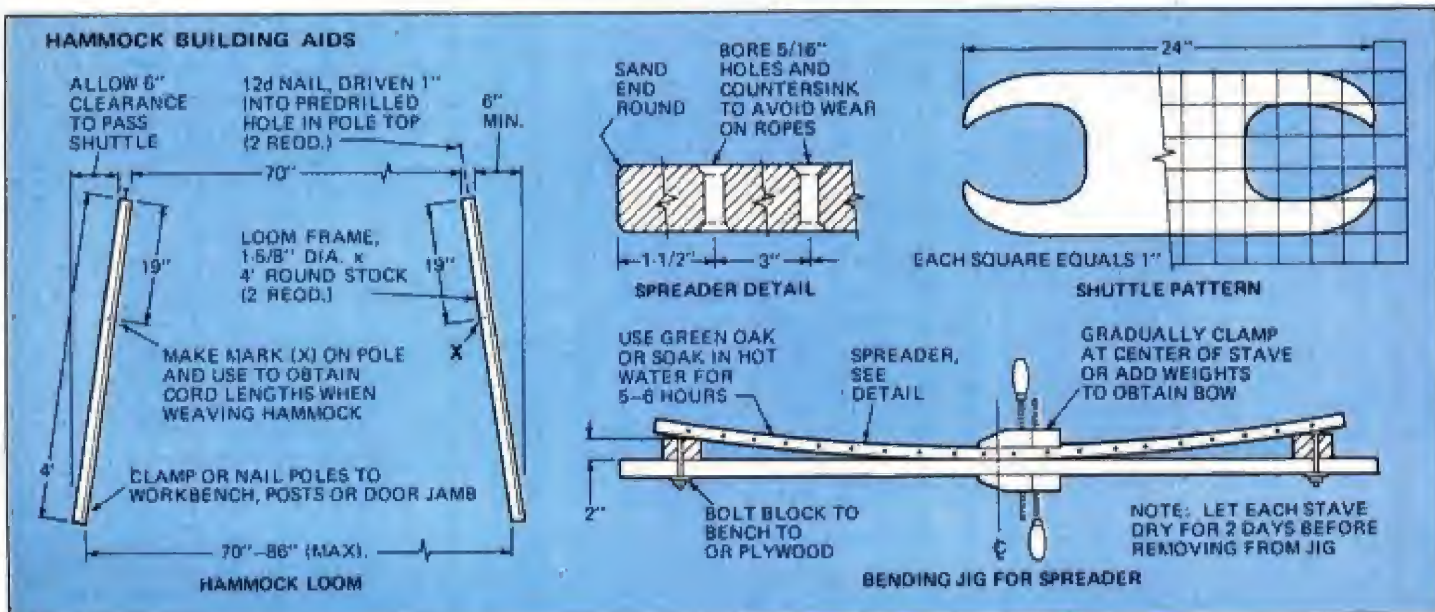
To help locate loops through which you'll be weaving, go back to the loom pole around which you

most recently turned and pull up on the cord attached to the nail. This will put tension on the last row worked and make it easier to spot.

When the shuttle runs out of cord, rewind it with a new supply. Tie the

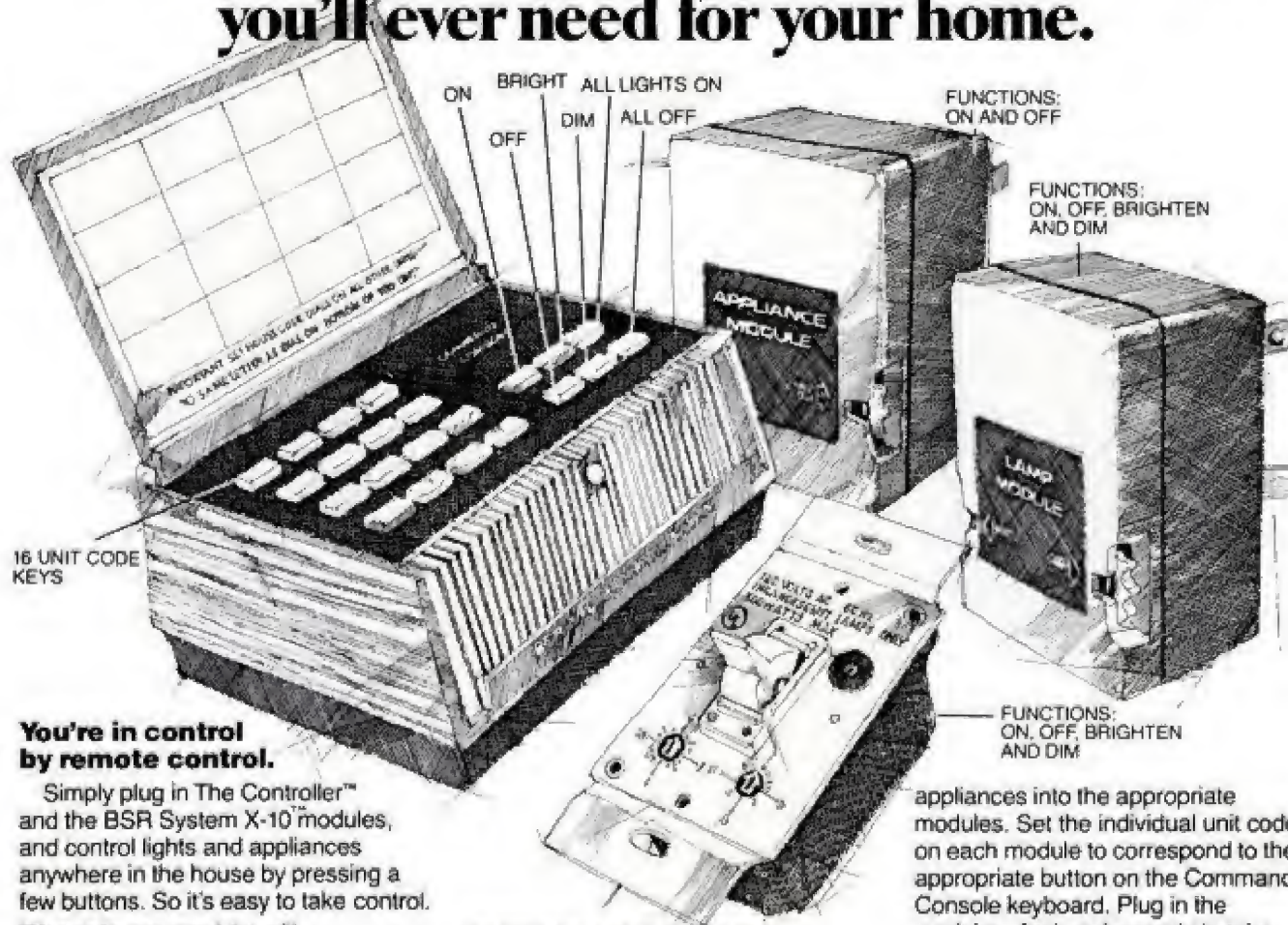
old and new together with a square knot at one of the loom poles so the knot won't end up in the middle of the hammock body.

When there are 37 rows, leave 9 ft. and cut the cord. Bind the end and





# An in-depth look at the only "plug-in" remote control system you'll ever need for your home.



## You're in control by remote control.

Simply plug in The Controller™ and the BSR System X-10 modules, and control lights and appliances anywhere in the house by pressing a few buttons. So it's easy to take control.

## There's no end to all of the control you've got.

You can turn on the TV, radio or stereo in the morning to help you wake up without getting up from bed. Or at night, turn on the lights before going downstairs so you don't have to fumble in the dark. Turn off unnecessary lights and help get your electric bill under control. Or, dim the lights and save energy, too.

And when it's time to turn in, just push a button and turn everything off. And sleep soundly. But, if you hear a strange noise in the middle of the night, you can press a button to turn on all the lights and scare the daylights out of an intruder.

## The Controller is designed to control every room in the house.

By pressing the buttons on the Command Console keyboard, command signals are transmitted over

existing household wiring to the module of your choice. The Lamp Module turns on, off or dims any incandescent lamp up to 300 watts. The Appliance Module turns appliances like TVs, window fans or stereos on and off. And the Wall Switch Module is designed to turn on, off or dim any light or lamp up to 500 watts normally operated by a wall switch.

There's even a Cordless Controller that transmits signals to an Ultrasonic Command Console from up to 30 feet away. So there's plenty of control for everyone.

## Simplicity is built into the system.



No special wiring is needed. Simply plug The Controller Command Console into any wall outlet in any room of the house.

Set your personal house code on the console. Then plug your lamps and

appliances into the appropriate modules. Set the individual unit code on each module to correspond to the appropriate button on the Command Console keyboard. Plug in the modules. And you're ready to take control.

## For under \$100\*, everything's under control.

The Controller Starter Kit comes with a Command Console and modules to control lights and appliances at three locations. The system is also sold separately, so you can add to it at any time. And stay in control.

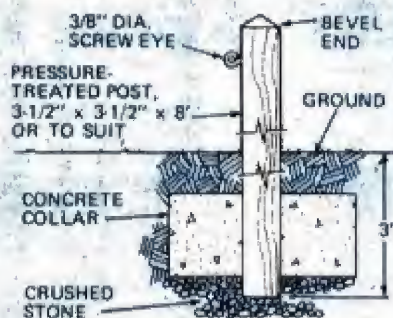
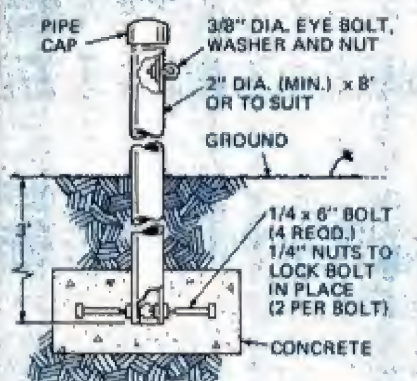


System X-10™

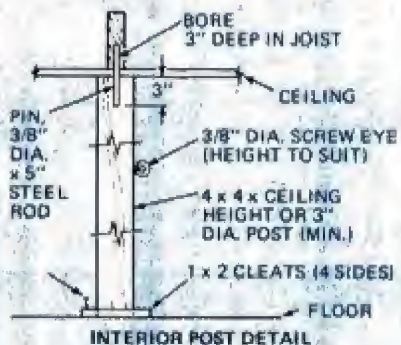
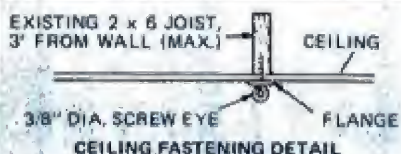
**THE CONTROLLER.™**  
Everything's under control.



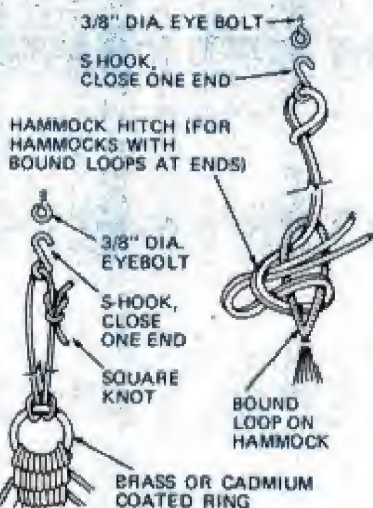
## HANGING KNOW-HOW



OUTDOOR POST DETAILS



INTERIOR POST DETAIL



EXTENSION ROPES FOR HAMMOCKS

## SHORT CUTS TO OWNING A HAMMOCK



**A** Pawleys Island cotton or spun polyester woven hammock retails for \$60 to \$70, depending on its size.

**B** Three-point polyester rope hammock (43 x 76 in.) is priced at \$58 (not including stand) from Algoma.

**C** Several manufacturers market go-anywhere, easy-to-stow, synthetic net hammocks for less than \$10.

**D** Folding hammock (45 x 84 in.) stores in a compact, upright position. It's \$60, from Algoma.



If you decide to buy a hammock, be sure to get one that's big enough. The compact nylon hammocks that you can stow in a shoe box may be too confining. Next, check the rope material for comfort. Cool, absorbent cotton is hard to beat, but some spun polyesters are supple. Polyester is also mildew- and rot-resistant.

Hammock stands usually cost as much or more than the hammock. Choose one that either folds or knocks down for easy carrying. Three-point stands and bed-type

hammocks offer greater stability than two-points, but sacrifice swaying.—J.P.

### MANUFACTURERS LIST

Algoma Net Co., 310 Fourth St., Algoma, Wis. 54201 (all types of hammocks and hammock stands).  
Gold Medal Recreational Products, Div. of Blue Mountain Industries, Blue Mountain Rd., Blue Mountain, Ala. 36201 (synthetic camper hammocks).  
The Hammock Shop (Pawleys Island Hammock), Box 308, Pawleys Island, S.C. 29585 (rope hammocks and stands).  
Hatteras Hammocks Inc., Box 1602, Greenville, N.C. 27834 (rope hammocks and stands).

thread it through the first braid you made at the first paper clip, and then through the first loop in the 37th row. Continue to alternate until the edging is joined to the hammock body. Then tie the cord end to the loom pole.

Before removing the hammock body from the loom, pass a cord through all the end loops on each pole. Tie the ends of each cord together and remove the hammock body from the loom.

To make each harness, cut 10 130-in. lengths and pass them halfway through a ring. Hang the ring on the wall between two flanking nails, as shown in photo on page 112, and arrange the strands in order with a distinct front and back row. Bring the rightmost strand on the back row over the rightmost strand on

the front row. Then weave it under the next strand on the back row. Continue across in this manner and place the strand over the left nail when done.

Now take the leftmost strand and bring it under all front strands. Place it over the right side nail. Repeat for each strand until two remain. Make a square knot.

Pass the 20 strands of each harness through the 20 holes in each spreader. Make overhand knots. Then hang the harnesses and adjust knots to equal tension on all cords. Repeat for the other harness.

Finally, group end loops of the hammock (count braid ends as one loop) in pairs and tie one harness strand to each group using a bowline knot. Trim and bind all the ends to prevent unraveling.

PM



# Now! A Scientific Way to "SCRUB" the Air Clean!

## Clear The Air with "NATURES-AIRE"

**Makes dust, odor and pollutants vanish—leaves the air country fresh**

Discover nature's own "secret" for fresh air... Ever notice how wonderfully fresh and clean the air is after a good thunderstorm? Well, it wasn't the rain that cleansed the air... it was the negative ions generated by the storm. Now you bring that same natural phenomenon into your home, office or car with Natures-Aire, the ion generator that works like Mother Nature to cleanse, purify and refresh the air you breathe!

### Natures-Aire—a controlled "thunderstorm"

That's right! Natures-Aire safely and electronically emits negative ions to create the same beneficial balance of ions found in the great outdoors—right in your home. You just plug it in and it silently and immediately begins to sweep unpleasant odors, smoke and pollutants from the air—leaves it refreshed and smelling sweet and country-fresh.

### Unlike many similar products

Natures-Aire produces precisely the right balance of ions—25,000/cm<sup>3</sup>. Scientific research has shown that much more or less would not have the beneficial effect. In fact, Natures-Aire is now the standard by which Underwriters Laboratories measures other negative ion generators. It is the first ion generator to receive U.L. listing.

### Negative ions—Nature's "Good Guys"

Though you can't see them working, negative ions actually grab on to particles of dust, smoke, organic and inorganic pollutants and sweep them from the air. Just as negative ions cleanse the air after a thunderstorm, Natures-Aire cleanses the air in your home with its gentle, controlled stream of negative ions—Nature's "good guys".

### Natures-Aire—no matter where you live

Studies show that winds carry harmful pollutants everywhere—even to tucked-away communities. That's why Natures-Aire is so vital for everyone. In the near future, negative ion generators will undoubtedly be standard equipment in airplanes, office and apartment buildings. But you don't have to wait! You can start protecting your whole family from harmful pollutants and unwanted odors right now with Natures-Aire.

### Perfect when you entertain

You'll love breathing purified air everyday, but imagine what a great benefit Natures-Aire will be when you have parties. No lingering cooking odors to embarrass you—no smoke filled rooms when the guests are gone! Yes, Natures-Aire will actually destroy stubborn odors, smoke, dust and other harmful pollutants in the air—not just cover them up with an artificial "freshener." Let's the whole family breathe easier! Just think what an important difference it will make to your personal environment.



listed by 

### Proven safe and effective

Yes, Natures-Aire's graphite conductive fibers are so safe a baby could chew on them. And Natures-Aire sweeps any airborne micron-size pollutants from the air and deposits them in the wall or floor. So effective at eliminating smoke and odors, you'll notice the pleasant difference in just minutes!



### Now—Mountain-Aire for your Car, Van, Truck or Boat

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# WORKSHOP MINICOURSE

## THE BLOCK PLANE

**E**ven if you own a shop that is fully equipped with stationary power tools, there are times when a plane is the tool you'll want. What better way to shave "whiskers" from end grain, or reduce a piece of wood to a carefully placed pencil line?

Though professional carpenters will often carry three or four different planes, the two that the average do-it-yourselfer need be concerned with are the block and jack planes. The latter is the larger of the two and is typically used for shaving swollen and stuck doors. We will discuss this plane in a future minicourse column. The block plane is a tool that you should try to master early in your woodworking career. This is one of the few tools—once you have become an expert in its use—that will assure you of having a neat, professional-looking finished project.

### Keep a sharp iron

In order to use this tool to its fullest, you must know how to grind and hone its cutting edge. Maintain the bevel that comes on the iron, about 25°, and hone the cutting edge after each grinding to razor-like sharpness.

Check any plane iron for sharpness with the same technique that is recommended for testing chisel sharpness. That is, hold the iron at 90° to your thumbnail and scrape lightly. A sharp cutting edge will remove a scant amount of nail. *Never* test for sharpness by rubbing a finger across the cutting edge.

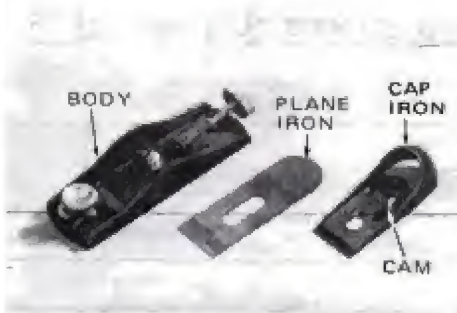
It takes practice to master a block plane, so start by working with scraps of soft wood (such as clear pine). Cutting strokes must be made with the grain; an against-the-grain stroke will cause the plane to chatter, or jump, which will result in chopping and uneven stock removal.

Once you have tried to cut with a plane against the grain, you will know why it is important to avoid this mistake. Also, practice by marking guidelines along a board's edge, just as you would to remove material from a door's edge. Vary the thickness of the material to be removed from, say, 1/8 in. to 1/2 in. This will help you develop a feel for setting the blade and stroking the tool across the work.

In general, the iron should be set



A block plane is the smallest smoothing tool that you're likely to have in your shop; it's also the one that you'll use most often. Iron is held rigidly by cap when the cam (arrow) is pushed to the right.



The basic tool consists of these three parts. As with its bigger cousins, the smoothing and jack planes, the tool's blade always should be kept razor sharp.



to a depth that produces scant stock removal. An attempt to remove too much stock in a single pass generally fouls the workpiece. Play it safe and try for thin continuous shavings.

When you plane the long edge of a vise-held board, you can guide the tool by extending several fingers down along the board's side.

Keep your tool in good shape; *always* retract the plane iron (to protect its cutting edge) after each use. Keep the tool clean and oil it occasionally to prevent any rust formation.



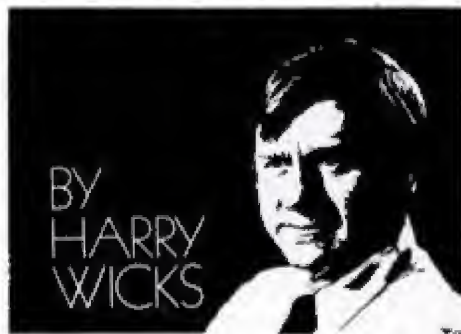
To remove the plane iron, push the cam to the left and simply lift off the cap piece.



Block plane is frequently used to smooth an end grain. If you try to make the cut in a single pass across the end, you'll likely cause splintering, as illustrated here.



To avoid splintering, make the planing cut from the corner to the middle (left), then repeat the stroke from the second corner (above). You should *never* make strokes from the middle to the corners.



BY  
HARRY  
WICKS





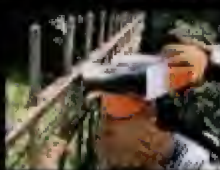
# WILL POWER vs. WHEEL POWER

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**WORK WHEEL**





# Build PM's ultimate desk for the crayon set

We put a giant version of the famous Binney & Smith crayon box to use as a fully equipped kids' work center.

by Harry Wicks  
HOME AND SHOP EDITOR

**B**y popular demand, the names and logotypes of famous manufacturers are appearing on everything from T-shirts to bumper stickers. And now we introduce our giant crayon-box work center featuring the instantly recognizable Crayola logo—the manufacturer has approved its use by PM readers on a work center built for their own use.

All kids who have seen this intriguing "box" take to it right away because there is an instant recognition of the logo. The fact that they play "in" the work center will keep the youngsters happy for hours on end.

## Rescaled 'crayon box'

We designed and proportioned the cabinet as close as possible to the scale of a real Crayola box, but the final dimensions were slightly compromised for practical considerations.

PM photos: color, Harry Hartman  
black and white, Rosario Capolisto  
Design: Douglas Eisman  
Construction design: R. Capolisto and the author  
Styling: Gabe Herrick  
Desk accessories: Binney & Smith, Inc. 1100  
Church Lane, Box 431, Easton, Pa. 18042



If we had scaled the box precisely—while assuming a 4-ft. width—the cabinet would have to be more than 7 ft. high. That's far too tall for sale and easy access to upper shelves by zealous youngsters of the age for which the unit is intended. The width

allows for ample desk space and a pair of doors wide enough to provide for a number of functions (as can be seen in the photos).

The unit is heavy enough for it to be freestanding. But, if the children who will use the desk tend to be overly





**1** Opened, the desk provides all sorts of room for storage and kids' activities. Notice the roll of paper for painting mounted in the door at left.

**2** Famous trademark shows when the doors are closed.

**3** Caster-mounted doors on the box make its opening and closing a snap for youngsters.

gymnastic, you had better secure the cabinet to the wall by installing three or four screws of adequate length through the cabinet back into wall studs.

The deep doors ride on globe casters which take the strain off of the

hinges and provide stability, especially when the doors are closed. For the latter reason, the casters are positioned toward the front edge of the doors—instead of at the back where they would be almost out of sight. However, if you decide to mount the

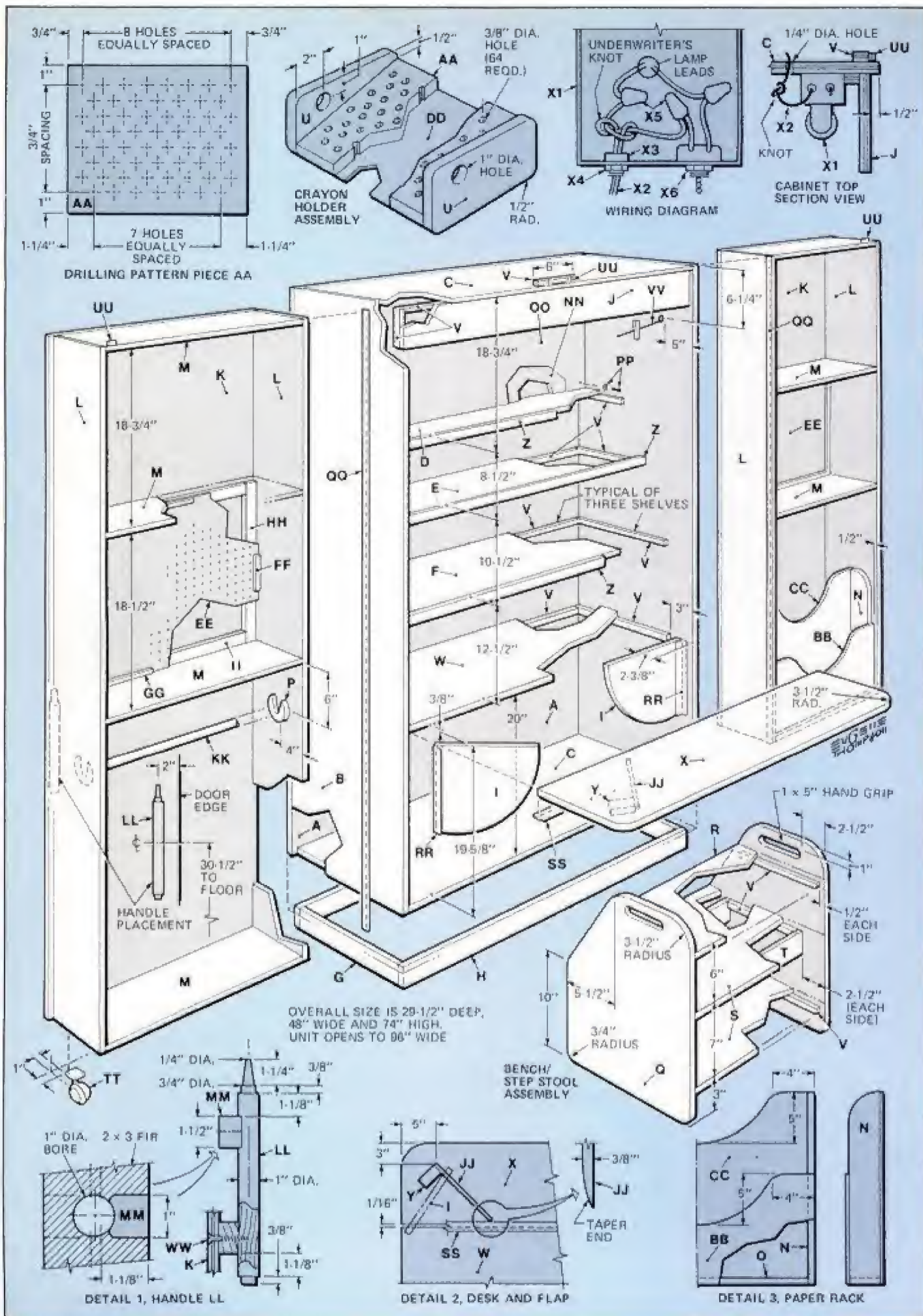


cabinet to the wall, you can place the casters in the set-back position.

The desk flap is supported by two swinging brackets that are positive-holding and safe. The space under the desk stores a combination bench/step stool. By standing on the middle or top step the average child can reach the upper areas easily. The 30-watt fluorescent lamp installed in the cabinet illuminates the cork display board as well as the desk work surface.

Except for the desk surface, which is made of  $\frac{3}{4}$ -in. pine, the entire cabinet is built of plywood. We chose Duraply MDO (medium density overlaid) plywood for the prototype—even though it costs more. This is top-quality fir plywood with a resin-overlaid surface which is ideally suited for painting. It saws without splintering and consists of sound inner plies. Note: Use MDO plywood which is sur-







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# DORAL II

This little tar-5mg.



But this much taste.



ONLY **5** MG TAR

Warning: The Surgeon General Has Determined  
That Cigarette Smoking Is Dangerous to Your Health.

MENTHOL: 5 mg. "tar", 0.4 mg. nicotine,  
FILTER: 5 mg. "tar", 0.5 mg. nicotine,  
av. per cigarette, FTC Report DEC. '79.





Bore lead holes for following nails along the center of all butt-joint locations. This is done to make certain that the nails will center in the mating pieces.



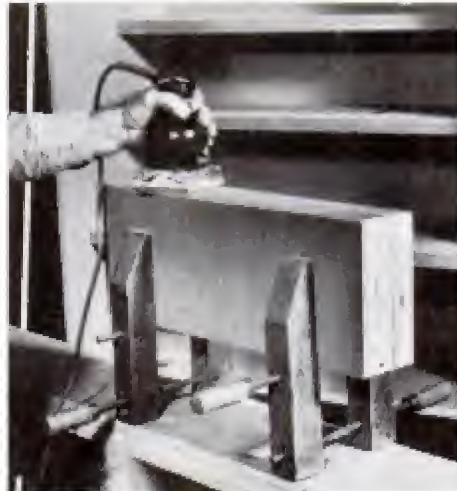
Glued-and-nailed cleats help to support the shelves and simplify assembly. Use galvanized nails for good holding power.



Fit the continuous hinge to the desk panel and flap before assembly. This beats working on your back and hoping for a good fit. Notice the spacing shim.



Parallel clamps are a must for holding the large shelves in place during first assembly stages. Start nails (to make locating holes) before you apply the glue.



To speed the task, gang-sand front edges of door horizontal members. Later, ease all sharp corners slightly with sandpaper.



With the doors resting in place on the cabinet, attach the hinges. Shims are used to create a small gap at the hinge edges.



Make the cork bulletin board easily by contact-cementing sheet cork onto Homasote board. Apply cement to both surfaces. Cork is sold by the roll at home centers.



This simple jig lets you "turn" the crayon handles with a disc sander. A working angle of about 10° creates crayon tip



Use large screws that penetrate the stand-off blocks and enter the hardwood dowels. Maximum holding power is a must here.

faced both sides (S2S) for cabinetry.

Much of this project involves cutting large plywood pieces with a portable saw. Use a fine-tooth plywood blade and a good straightedge guide. When you cut a 6- or 8-ft. length, drive a few nails into the guide strip—and partly into the work-piece—to prevent bowing.

Start with cabinet cross members. Rip off 1 in. along a long edge so you have a sheet 47 in. wide. Next, cut the top, bottom, shelves and light-shield strip to size. If the 47-in.

width is cut accurately, these inside-fitting pieces will be the same length, and you will have trouble-free cabinet assembly. Desktop and shelf stiffeners must also be cut to the 47-in. dimension out of the ¾-in. stock.

Cut the back and two side panels to size and mark positions of horizontal members on the insides of these pieces. Using a drill bit, bore pilot holes along centerlines.

For strength at butt joints, pre-

*(Please turn to page 144)*



Photo above shows the setup for boring perpendicular crayon holes in the holder's angled surface. The drill bit is the brad point type—perfect for this purpose.



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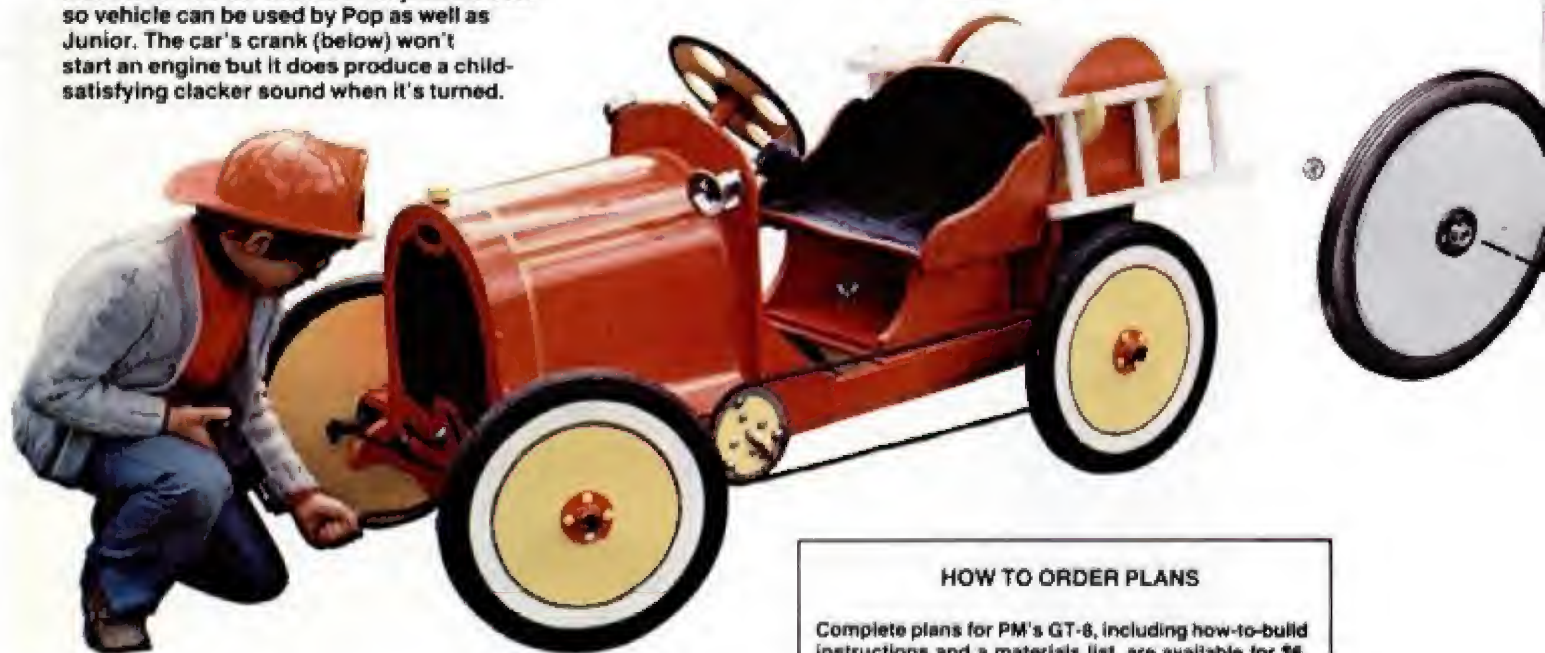
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PM's kids' version of the Grand Touring cars of old can be used safely on open fields (above) as well as on driveways and sidewalks. The car boasts an adjustable seat so vehicle can be used by Pop as well as Junior. The car's crank (below) won't start an engine but it does produce a child-satisfying clacker sound when it's turned.



#### HOW TO ORDER PLANS

Complete plans for PM's GT-8, including how-to-build instructions and a materials list, are available for \$6. Send check or money order to PM GT-8, Stevenson Publications, Box 584, Del Mar, Calif. 92014. Allow two to four weeks for delivery for third-class mail; add 75 cents if you prefer faster first-class mailing.



# Build the GT-8:

## PM's grand tourer for 8-year-olds

Build this classic and your child will draw a crowd wherever he pedals it.

by Harry Wicks HOME AND SHOP EDITOR

**T**he talk about creating a pedal car such as this one—which PM's readers could duplicate—began more than five years ago. The major obstacle was the lack of lightweight, sturdy, old-style wheels at a reasonable price.

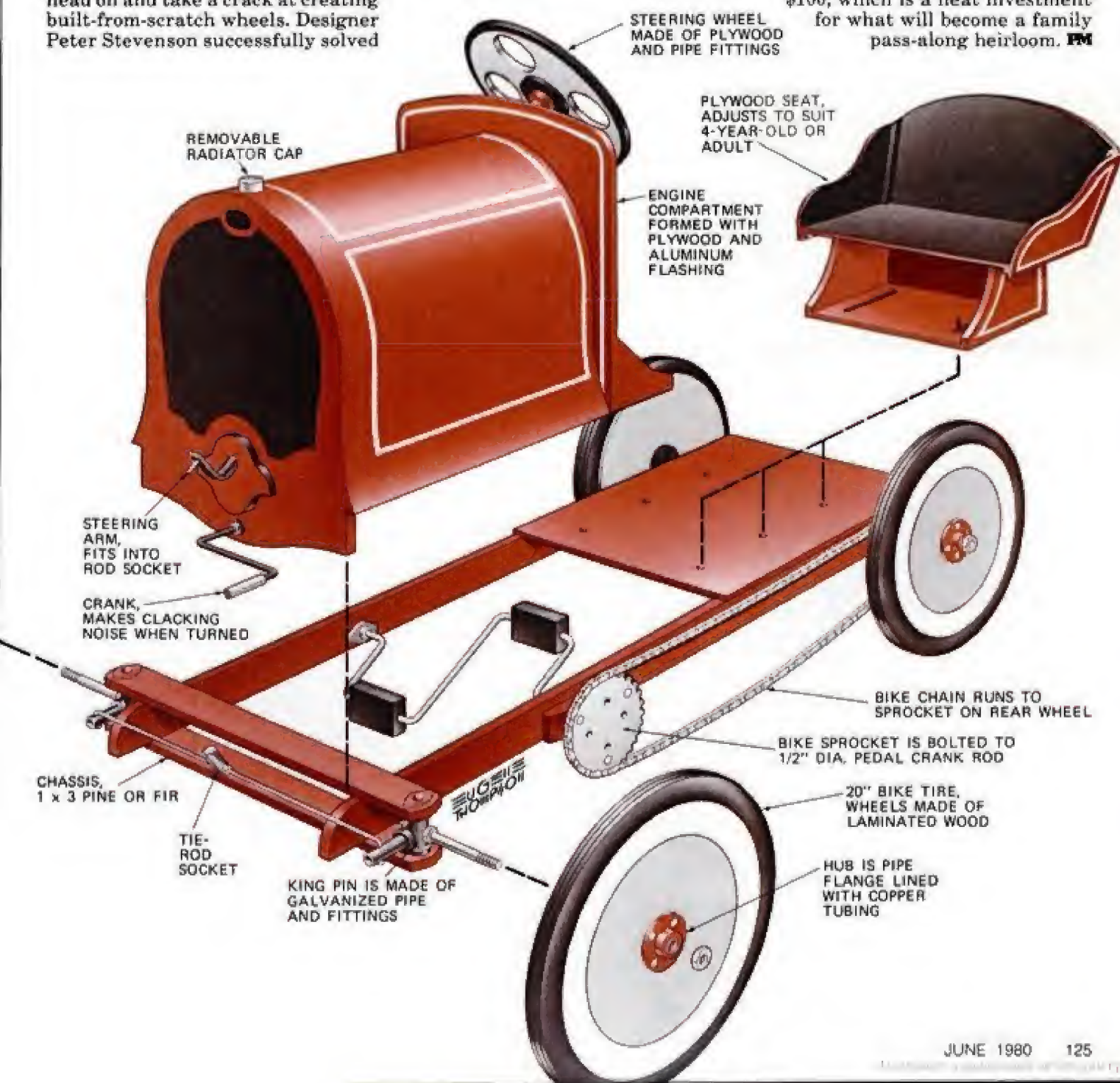
We decided to meet the problem head on and take a crack at creating built-from-scratch wheels. Designer Peter Stevenson successfully solved

the problem. His light, free-rolling wheels are made of laminated lumber and plywood, using standard bicycle hubs.

Parts for the car are easily purchased at lumberyards and plumbing-supply houses. The plans (see

facing page) include a materials list to make shopping a snap. The car handles nicely and doesn't require any special tools or welding equipment to construct.

Depending on what materials you can salvage from an old bike, the cost to build the pedal car is about \$100, which is a neat investment for what will become a family pass-along heirloom. **PM**





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## BEATING TV INTERFERENCE

(Continued from page 89)

near a TV set tuned to Channel 13. Dial the radio down to the 96- to 97-megahertz range and observe the variety of interference patterns on the screen.

If your own FM receiver is the problem, just move it a little farther away from the TV set. If the FM TVI is caused by a broadcast station, start by installing an inexpensive FM-band rejection filter at the rear of the TV set. Connect the filter to the antenna leads as instructed in the literature that comes with it. Use a connector cable of the same type as the existing antenna lead. This may be a simple twin-lead wire or a coaxial cable; just don't mix the two types.

If you have an antenna amplifier, install one filter before the amplifier and a second one ahead of the TV receiver input terminals. You may also be instructed to add a ground wire which should be kept as short as possible. If the filters don't solve the problem, call a serviceman for in-set modifications.

### 4. Computer-generated TVI

This is generally not a problem unless the computer is quite close to the TV set. During our tests, Channels 2, 4 and 13 were found to be most sensitive to computer radiation. However, the radiation put out by some other computer might affect a TV set differently, perhaps on other channels, and produce other types of interference patterns.

If a neighbor buys a hobby computer, don't be in a rush to blame him for all your TV interference problems. It's simple enough to check it out by turning the computer on and off while watching the TV set. Not all computers create TVI, even when operated next to the television receiver.

### 5. Ghosting

This is a formation of double images and occurs when the TV signal travels along two paths of different lengths from the broadcast tower to a receiving antenna. However, ghosting can also be caused by a poor TV antenna and/or lead-in wire, or merely improper aiming of a directional-type antenna. Check these possibilities first.

If the problem obviously relates to multipath reception of a reflected signal, try moving the antenna to a different location. If that doesn't cure the problem, replace the antenna with a more directional type, and be sure to use shielded-type lead-in wire.

If you observe ghosting and significant blurring or other distortion of the picture, this is a pretty good indication that the difficulty is twofold: ghosting and a weak signal. Once again, the best solution may be either to aim the antenna more carefully or switch to a more directional antenna.

### 6. CB radio interference

This can be caused by citizens band and amateur "ham" radio transmissions, but also by transmissions by police and other public service radios.

Such TVI characteristically occurs in the form of dark parallel lines tilted slightly off the horizontal. These patterns are easy to confuse with similar effects caused by horizontal-hold problems in the TV set. But these aren't the only interference patterns produced by radio transmitters.

The actual effects vary greatly depending on many factors, including the strength of the radio signal and whether the radio operator is actually talking or merely sending out an unmodulated carrier wave.

If the TVI is, in fact, due to radio interference, the pattern will pulsate as the radio operator talks, and may even bounce back and forth between the parallel-line pattern and more random patterns.

You will not observe such pulsations if the parallel lines are caused by horizontal-hold problems; instead you may hear a high-pitched tone. To cure a hold malfunction, readjust the horizontal-hold control. If that doesn't work, have a serviceman replace a bad component.

Eliminating radio transmitter TVI can be a problem. You should begin by installing an inexpensive high-pass filter at the antenna terminals of the TV set. Be sure to use the same type of connecting cable as is used for the antenna lead-in (either twin-lead wire or a coaxial cable). Put one filter ahead of an antenna signal amplifier you may be using and a second filter at the TV set. If the filters don't fully cure the problem, consult your serviceman about possible modifications of the TV set's internal circuitry.

### 7. Co-channel images

This resembles ghosting, but is easily recognized because the second image is usually of a different program, which means it is coming from a second TV broadcast station. Remember, true ghosting involves a duplication of the same TV program material.

Co-channel interference is most

(Please turn to page 128)

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## BEATING TV INTERFERENCE

(Continued from page 126)

commonly caused by atmospheric conditions that permit signals from a very distant station to bounce back down from the upper atmosphere and thereby "skip" to receiving areas they normally wouldn't reach. There's nothing to do about a temporary problem except wait until the atmospheric condition clears, usually within an hour or two.

However, if you experience *persistent* co-channel interference, it means that you are located where it is possible to pick up signals regularly from two broadcast stations on the same channel. You may be able to cure or minimize the problem by installing a highly directional antenna. If some interference persists, try reducing the signal strength with a tunable signal attenuator that actually weakens the signal getting into the TV set.

### 8. Airplanes and windmills

Here are but two examples of miscellaneous outside sources of TVI. The whirring blades of a helicopter (eggbeater) or the wings of a banking 747 can cause TV interference. The display may tear badly, and there may be a temporary loss of color. The problem is really troublesome only near busy airports.

Some channels may be more sensitive than others to such disturbances, perhaps partly because of weak TV signals. The installation of a better antenna, use of a shielded coaxial lead-in cable, and addition of an antenna signal amplifier can greatly reduce the effects of aircraft.

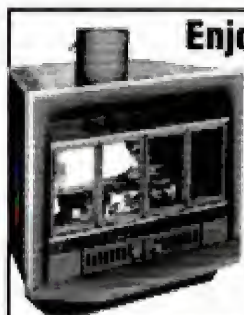
A similar problem can be caused by windmills! People living in rural areas may already be familiar with this source of TVI, and the problem may become more widespread if windpower develops into a significant energy source in the years ahead.

Of course, there's also TVI that originates from malfunctioning equipment at the TVI broadcast station, and the broadcaster usually—but not always—announces that fact. If you observe bad color or other picture distortions during the presentation of field-recorded news broadcasts, for example, it may be due simply to a malfunction or inexperienced use of the broadcaster's portable camera equipment.

### Additional tips

If a specific ham or CB transmitter in your area obviously relates to your TVI problem, work with the

(Please turn to page 130)



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### BEATING TV INTERFERENCE

(Continued from page 128)

operator to check his equipment for proper performance. See if the rig is properly grounded, test for harmonics and/or spurious emissions, and add a good earth ground if the transmitter cabinet radiates energy. Install a low-pass filter on the transmitter antenna circuit to see if the TVI pattern is affected by changes in harmonics and/or spurious emissions.

If these measures fail, go back to the TV receiver and recheck all antenna connections. If there's an antenna signal amplifier, remove it temporarily. If this eliminates TVI, reconnect the amplifier, but protect it against radio frequency (RF) pick-up as follows: 1. Add grounding; 2. enclose the amplifier in a metallic RF-proof housing and ground the housing; 3. install a high-pass filter at the input to the amplifier; 4. install a second such filter in series if the first one is not adequate.

Add a purchased a.c. power-line RF filter to determine if the RF from the transmitter is entering the TV set by way of the power cord. If the TVI persists, even when the antenna is disconnected, look for the problem inside the TV set, especially at the tuner. Disconnect the antenna input lead inside the set at the tuner. If the TVI is eliminated, install a high-pass filter at the tuner. If this doesn't cure the problem, each stage of the TV must be tested—a job for a repairman.

Electrical TVI caused by sparking home appliances and tools can often be eliminated by adding capacitor bypasses. However, the modifications must be done with extreme care, especially when bypassing appliances having capacitors. Dangerous voltages may exist, the a.c. power line might accidentally be shorted and an inexperienced do-it-yourselfer can invite electrocution!

Arcing between the brushes and commutators of infrequently used power tools are best left alone. If the tools are in constant use, TVI can be reduced by bypassing each side of the line to the other side and to ground with capacitors. The on/off switch also should be bypassed.

Also, .001-mfd. capacitors may be used to bypass arcing contacts in such thermostatically controlled appliances as electric blankets and fish-tank heaters. Defective TVI-producing doorbell transformers should be replaced. Dimmer switches that utilize SCRs or triacs can cause much hard-to-eliminate TVI. However, bypassing with capacitors may help somewhat. **FM**

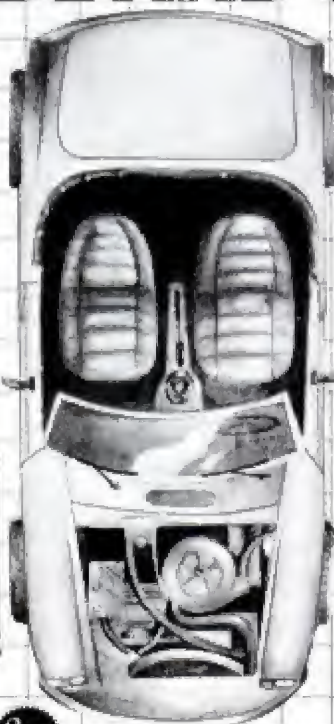
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## DON'T GET BURNED BY SOLAR RIP-OFFS (Continued from page 85)

tified *Solar Collector Ratings*, which evaluates the performance of a few dozen collectors. Contact the energy offices of any of the 10 northeastern states or Florida to find out which collectors have passed the performance standards set for the 10,000 hot-water grants of \$400 each, issued in the past three years by the U.S. Department of Housing and Urban Development. The Florida Solar Energy Center also has tested more than 150 collectors made by scores of manufacturers. Send for its summary data sheet.

Fully understand a solar system before proceeding. In theory, it's simple: The sun heats a black "absorber plate" in an insulated box, covered with glass or plastic to accept light and trap heat. Water or air flows to the collector, where it picks up heat for use in your house. In practice, however, solar systems are complicated.

### How systems fail

As you examine the diagram on page 84, you can begin to see where problems might develop. For example, if sensors or pumps are installed backwards, systems can heat the collector (and thus the sky) and cool hot-water tanks. It has happened. In fact, in some badly designed systems, the collector was protected from freezing by pumping up warm water from the storage tanks—water already heated by the collectors or by conventional fuel. Instead, of course, the collector should be protected with antifreeze, or be automatically emptied (through the drain) into a pail or outlet when the temperature gets too cold. It would then be filled automatically when the outside temperature increased.

Good systems include safety features such as a stagnation temperature relief valve, expansion tank, or both, in case the pump fails. Without such safety features, the sun could raise the collector temperature to 400°, blowing out the collectors or causing other serious damage.

The size of the storage tank or bin is also critical. In Roanoke, Va., one man bought a domestic hot-water system with a 2000-gallon storage tank, instead of the usual 60 to 120 gallons. The tank collected a lot of B.T.U.s of heat, but they were spread out over so much water that the fluid only increased a few degrees in temperature. The system was useless without a smaller tank.

It almost goes without saying that energy conservation comes before solar energy. For a hot-water sys-

tem, insulate the tank and pipes. For heating, insulate the attic, buy storm windows and caulk and weatherstrip windows and doors.

### Choosing a collector

California has a lot of swimming-pool heaters. One, a black hose, came in a coil and was installed on the roof. In one Palo Alto installation, a high wind unrolled the hose about 10 feet. It smacked into a second-floor window and emptied the pool into the bedroom.

Always choose a collector that (1) has been approved in a federal testing program, (2) looks good in the solar industry's rating booklet, or (3) is highly rated by an independent laboratory. All reputable collectors will have undergone stagnation-temperature tests. Ask for documentation.

First define your needs: domestic hot water, swimming pool or heating (air or water). Space heating usually requires higher collector temperatures than hot water. So heating systems often have double glazing and an electroplated black collector coating, to absorb more incoming light.

The longest-lasting collectors are copper. Galvanized steel and aluminum are subject to rusting, pitting or other corrosion. Add buffers to the water or antifreeze.

If you are a do-it-yourselfer, the specific collector you choose will probably depend on price and ease of installation. If you're hiring someone, depend on what's local: You don't want a dealer who's 200 miles away if you have a problem.

A final note on collectors: A recent study by the Solar Energy Research Institute in Colorado found a thermosiphoning system to be the most efficient of all. In such a system, the collector and the tank are on the roof, with the tank higher. The water circulates by siphoning; there is no pump. Of course, the system can't be used in freezing weather. But if you don't mind a tank on your roof and no solar-heated water on freezing days, consider it. The system costs less than \$1500.

### Picking a contractor

The best solar system in the world is thoroughly useless when installed by an incompetent contractor. In Florida, a perfectly good pump was installed upside down, so it could not be oiled—and it needed to be oiled. In Miami, a solar installer put in high-temperature collectors for a low-temperature swimming-pool system. The plastic pipes melted.

(Please turn to page 132)

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### SOLAR RIP-OFFS

(Continued from page 131)

In one development near San Diego, rooftop collectors face east, west, south and in between. Installers apparently just followed the roofline, ignoring the direction from which the sun shines.

Usually, the dealer will also install the system. First, make sure he is experienced: Ask for the names of 10 customers, and visit at least three. If the dealer won't cooperate, leave.

### Solder blocks a pipe

Grill the customers. Has the system leaked? Did the workmen kick the dog and track mud all over the carpets? Ask them how they know the system is saving money. One woman in Florida told researchers that she loved her system, but closer examination revealed it wasn't supplying any heat: A piece of solder was blocking a pipe.

Call agencies and ask for previous complaints: the local consumer affairs department and better business bureau, the state contracting license board. Consider asking your bank to do a credit check on the company principals and on the firm. The bank may do this as a courtesy or will charge a nominal fee, perhaps \$20. The credit check will determine how sound the company is and whether there are any major judgments against it.

Execute a contract, specifying the type, number and price of all materials to be used. This is important: A few southwestern solar-water heater distributors were caught switching—installing cheaper and less efficient collectors than what the customer paid for.

In all cases, get a collector warranty at least as strict as the one required by the U.S. Department of Housing and Urban Development for all systems installed under its grant program. That is a full one-year warranty on minor parts such as valves and sensors, and a five-year warranty on the collector, pipes and pump. There must also be a five-year guarantee against corrosion. Try to get a full year's warranty on the installation, too—California requires it—but settle for 90 days.

And consider requesting a performance bond, in which a bonding or insurance company guarantees both the collector and the system. After all, solar companies do go out of business—in which case all their guarantees are worthless. Usually the bond costs one percent of the to-

(Please turn to page 134)

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\*Look for the Assembly Line and "Sporting Offer" details at participating stores.

PM

## SOLAR RIP-OFFS

(Continued from page 132)

tal bill. If bonding companies won't issue one, you know there are problems with the solar company. Get everything in writing.

You should perform several other checks to discover how good the contractor is. Ask if the firm belongs to the National Assn. of Solar Contractors, comprising 400 carefully screened and experienced solar contractors.

Check on whether the contractor's installers have taken a solar installation course approved by the federal government, major university or accredited institution.

Even for small jobs, consider paying a solar expert a small consulting fee to check plans and test data.

Above all, don't rush. *The sun will be there tomorrow.* And it's a buyer's market right now.

## Having it installed

Just because the contractor has good installers, it doesn't mean they will be used on your job. Check the credentials of the *specific* installers for your collector system. At least one should be a licensed plumber and two should have solar experience.

If you can, be there when the system is installed. Bring diagrams with you. When it's finished, *inspect everything*. Have the installers walk you through the system before it's activated. Ask questions. "It takes only one small oversight to really mess up a house," says Edwin Papworth, a Virginia solar contractor.

Finally, have a checkup from the contractor after a week or two of use.

"I do believe it's possible to buy a solar system and save money," says Genen, the New York assistant attorney general. "And I'm a great believer in solar. But one thing is sure. If you don't take the time to do it right first, you may have very little recourse later."

PM

## Where to obtain further information

Florida Solar Energy Center, 300 State Road 401, Cape Canaveral, Fla. 32920. Free booklet: *Turning on the Sun*.

National Assn. of Solar Contractors, Suite 928, 910 17th St. N.W., Washington, D.C. 20006. Will send you the names of approved contractors near you.

National Solar Heating and Cooling Information Center, Box 1607, Rockville, Md. 20850.

Northeast Solar Energy Center, 470 Atlantic Ave., Boston, Mass. 02111. Free booklet: *Solar Water Heating: What's in it for You*.

Sheet Metal Workers International Assn., 1750 New York Ave. N.W., Washington, D.C. 20006. Offers written guarantee for installation on a solar system put up by its members.

Solar Energy Industries Assn., Suite 300, 1001 Connecticut Ave. N.W., Washington, D.C. 20036.

Solar energy office of the California Energy Commission, 1111 Howe Ave., Sacramento, Calif. 95825. Publishes dozens of brochures, most free. Also lists performance data on more than 100 collectors it has tested.

Solar Energy Research Institute, 1617 Cole Blvd., Golden, Colo. 80401. Its Dec. '79 *Monthly Review* contains data on relative solar system performance.

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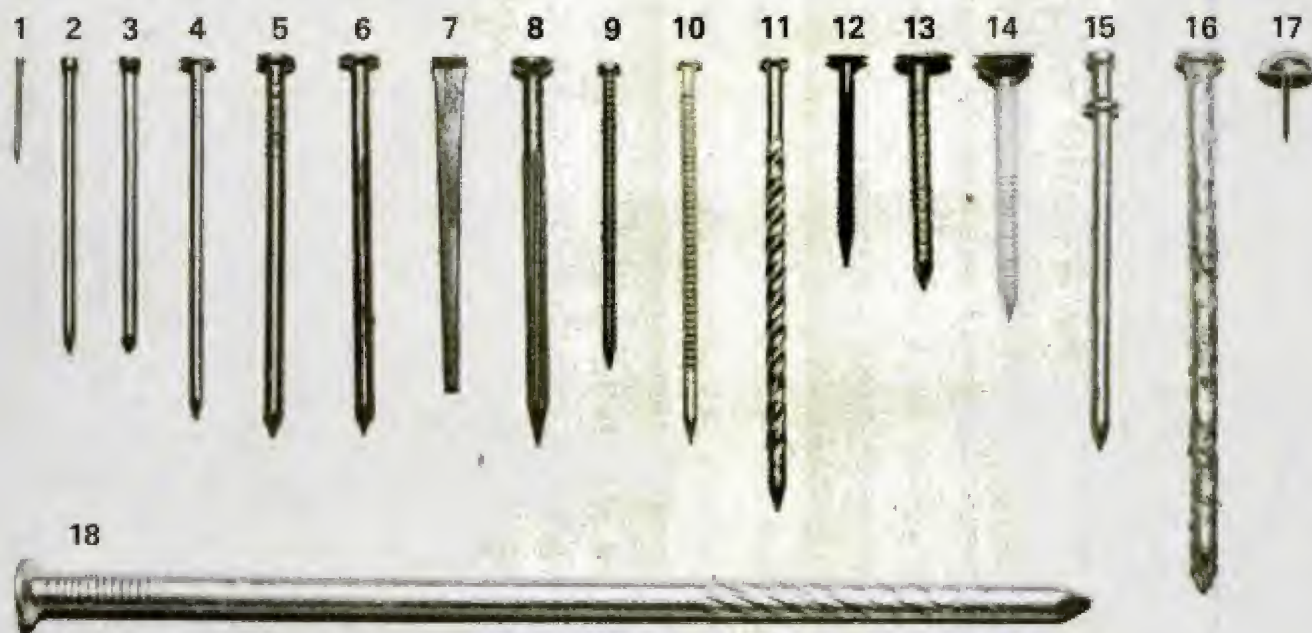
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# Nails—still the handiest fasteners in the workshop



All nails were created for a purpose. Here's a guide to help you pick the one that's best for the task at hand.

by Rosario Capotosto

**N**ails provide one of the simplest and easiest ways to fasten things. But all nails are not the same. So in order to do a job properly and most effectively, you should know some basics about the variety of nails that are available. The following guidelines—prepared with the help of the nail-producing people at Armco's Western Steel Div.—will enable you to match the nail properly to the job.

## Form follows function

Nails differ according to size, shape, material and finish. In various combinations, these factors have a direct bearing on the intended use of the nail.

Nail lengths are designated (somewhat confusingly) in both inch and "penny" sizes. The latter is indicated by a whole number followed with a small "d," which is an ancient abbreviation for penny (See *History of Penny-sizing*, page 139). Generally, as the length of a nail increases,

so does its diameter or gauge. Nail gauge refers to the diameter of the wire from which it is made. No. 1 gauge is the largest; 20 gauge, the smallest.

Shapes of nailheads, shanks and points vary considerably (see chart on page 138). Nail finishes can be bright, cement-coated or galvanized. Each of these characteristics serves a specific purpose.

For use around the home and shop, nails may be grouped in two categories: general-purpose and special-purpose. General-purpose nails are available in four types—box, common, casing and finishing.

Common nails have a large, flat head, smooth shank and diamond point. They are used for all types of general construction and rough carpentry where appearance is not of primary importance.

Box nails are similar to common nails with one important difference: The box nail has a larger-diameter head in relation to shank diameter. The large heads of both nails hold the nailed member securely by spreading the load or grip over a broad area. When nailing thin stock—which has a tendency to split with a thick-shank common nail—the thin-shank box nail is used instead. The alternative is to predrill holes in the top member, which is tedious and time-consuming.

A lineup of useful nails: (1) brad; (2) finishing; (3) casing; (4) box; (5) common; (6) cement-coated box; (7) cut flooring; (8) fluted masonry; (9) wood shingle; (10) asbestos shingle; (11) exterior hardboard; (12) drywall; (13) barbed roofing; (14) neoprene-seal roofing; (15) double head; (16) hot-dipped galvanized; (17) upholstery; (18) gutter spike (also comes with chisel point).

Casing and finishing nails have very small heads and are the choice for cabinet work, molding, window and door trim, and wherever a finished appearance is important. Both are available with either a cupped or flat brad head.

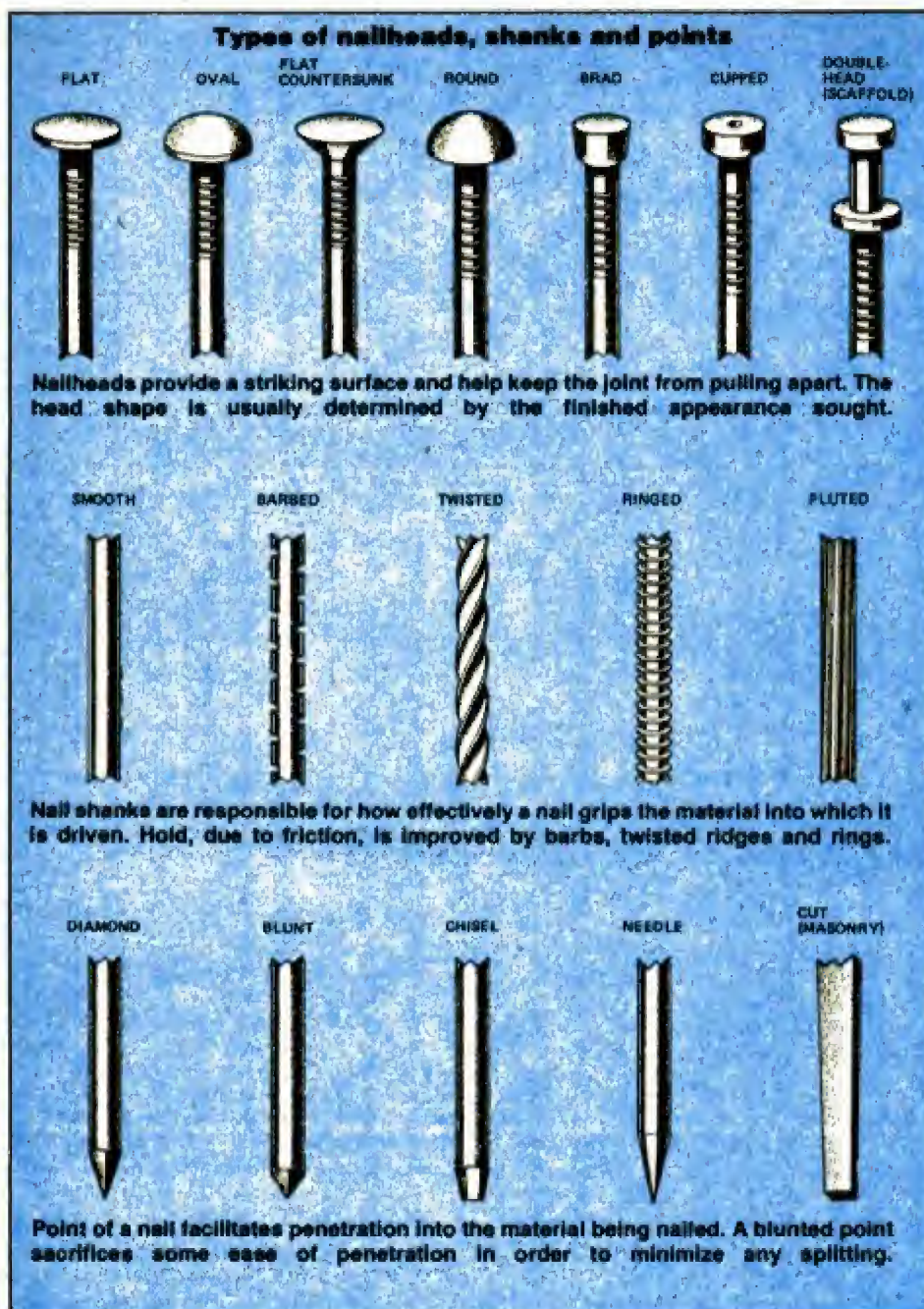
Cupped versions have a slight indentation in the head to accommodate a nail-setting tool. A nailset is used to sink the nailhead slightly below the surface. The hole is filled and sanded for total concealment.

Nails with flat brad heads are intended to be driven flush to the surface. They cannot be set properly because the nailset tends to slide off the smooth surface.

The difference between the casing and finishing nail is similar to the difference between the common and box nail—a casing nail is thicker than a finishing nail of equal length. Brads are small finishing nails sized from  $\frac{3}{8}$  to 1 in. They're designated by inch length and gauge rather than penny size.

In general, the proper nail size is dictated by the thickness of the sur-





face board being nailed: The nail should penetrate two times the thickness of the top board to gain sufficient holding power. For example, when nailing through nominal 1-in. stock ( $\frac{3}{4}$  in. actual), the nail should be at least  $2\frac{1}{4}$  in. long (7d or 8d). Of course, there are exceptions to this rule. It won't hold when fastening  $\frac{1}{8}$ -in. sheet metal, for instance.

#### Nails for special jobs

The above-mentioned nails will do fine for average nailing requirements, but they won't do when you need extra holding power or rust resistance, or when you want to attach plasterboard, hardwood flooring, roofing or wood to masonry. For these jobs, a variety of special-purpose nails have been developed with distinct advantages for particular applications.

Most special-purpose nails are named to signify their specific use, such as for roofing, drywall, underlayment and masonry. Others are named for significant characteristics, such as ringed, cement-coated, galvanized and double-head.

Different physical characteristics bring about the improvements in special nails. Extra holding power is achieved by special shank shapes, such as barbed, twisted, fluted and ringed. When an ordinary nail is driven into wood, the squeeze of the displaced fibers against the nail serves to hold it in place. However, a smooth-surfaced nail will have a tendency to withdraw slightly if the joint remains under stress for a period of time. In addition, as the wood ages, the wood fibers often lose moisture and shrink, thereby enlarging the nail hole and, in effect, shortening the nail depth. This results in

loosened nails or protruding nailheads. A common example of this is a "popped" drywall nail—one that has been pushed from its hole by green lumber that has dried and shrunk. Use of the newer drywall nails with ringed shanks helps to eliminate this. Other irregular-surfaced shanks are designed to prevent loosening.

Cement-coated nails have a resin coating that also provides more friction and greater holding power. However, they are not more effective than nails with shaped shanks.

To protect nails against atmospheric corrosion, a coating of zinc (galvanizing) is applied to the surface. When applied by an electrolytic process, the coating is smooth and thin and the nails are termed electrogalvanized. This treatment offers only moderate protection. For maximum resistance to rust, hot-dipped and tumbler-galvanized nails are recommended. Due to their very coarse surface of zinc flakes, these nails also possess remarkable holding power. They are, however, somewhat harder to drive than smooth nails.

Most nails have standard diamond points, but some special-purpose nails are characterized by blunt, needle and chisel points. Hardwood flooring nails come with blunt diamond points. These reduce the possibility of splitting because the point shears through the fibers instead of slicing through, as would occur with a regular diamond point. The slicing action spreads the fibers, resulting in a split.

Softwood fibers are more resilient so that a regular diamond point can penetrate without causing a split. A good trick when splitting occurs while driving ordinary pointed nails is to blunt the point with a light hammer blow.

Chisel points are found on heavy-gauge gutter spikes and heavy hinge nails. The shape of this point allows these extra heavy gauge nails to be driven into heavy timbers with relative ease.

Needle points are usually found on nails used on insulated building board and fiberboard. The sharp point makes penetration easier and reduces the chance of deforming the material.

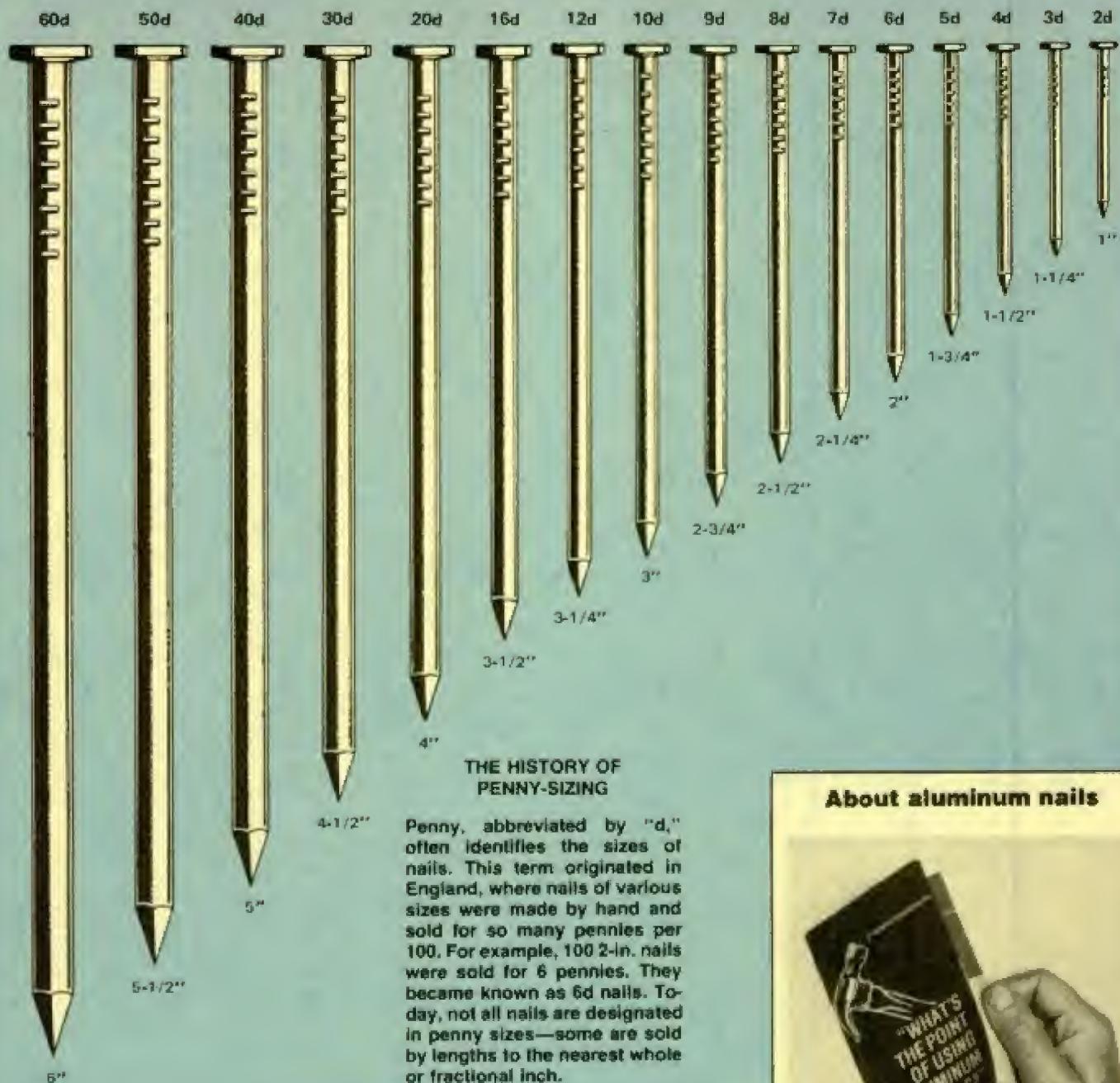
#### 12 popular, special nails

**1. Cement-coated:** Box, casing, common and finishing nails, as well as most other types, are available with optional cement coating.

**2. Concrete and masonry:** Several types of masonry nails are available for fastening wood or other



Actual-size nail reference chart



### About aluminum nails



Aluminum nails can be used for: wood siding and shingles, asbestos siding and shingles, aluminum siding and trim, plastic panels and roofing, gutters and downspouts, porches and decks, outdoor furniture projects and for fencing. They are strong and durable—and will not cause rust stains when exposed to the weather. Styles and advantages of aluminum nails are described in a brochure, *What's the Point of Using Aluminum Nails?*. Obtain a free copy by writing to the Aluminum Assn., Inc., Dept. PM 680, 818 Connecticut Ave. N.W., Washington, D.C. 20006.

materials to masonry walls and floors. They come with smooth and round, square and fluted shanks. The last two provide maximum holding power. All are hardened. Hardened nails are particularly susceptible to chipping at the head when struck with an erratic hammer blow. Therefore, wear safety goggles when driving hardened nails to protect your eyes, and use a heavier hammer or hand sledge to do the driving. Masonry nails have very little tensile strength (resistance to pullout), but do have good lateral strength (resistance to shear).

**3. Drywall:** This is the nail to use for attaching plasterboard sheets to interior wall studs, joists and rafters. The newest type has rings for superior holding power, a coun-

tersunk head that drives flush to the wallboard without cutting the paper, a depression in the head that ties in the joint cement, and a sharp point for easy nail starting. This type is far superior to the conventional drywall nail.

**4. Double head:** Intended for temporary lumber construction such as concrete forms and scaffolding, this nail is simply driven to the lower head for a solid assembly. The projecting upper head assures fast and easy withdrawal when dismantling is desired.

**5. Flooring:** There are several types of flooring nails, the oldest version being the cut nail. This has a rectangular cross section and a flat, blunt tip that is capable of penetrating hardwood flooring edges with-



out causing splits. A more widely used type has a twisted shank and blunt diamond point. Also available are smooth-finish and cement-coated types. Some are made of stiff steel to resist bending.

**6. Gutter spikes:** These are long nails used for attaching and supporting rain-gutter systems. They are available galvanized with flat or oval heads and diamond or chisel points.

**7. Heavy hinge:** This is a smooth-shank nail with a chisel point used for fastening hinges on heavy doors. It's available with an oval, or flat, countersunk head.

**8. Lath:** A thin-gauge nail with a flat head used for attaching wood lath to studs.

**9. Roofing:** There are two types of roofing nails made for residential applications. The most common is

the large, galvanized flathead nail with a barbed shank that is used for nailing asphalt shingles, roll roofing and felt.

The other is a sealing roofing nail. It has a neoprene washer under the large head and is used to secure metal and fiberglass roofing and siding sheets. The washer effectively seals the nail holes against rain and wind. Its ringed shank provides good holding power. Roofing nails are usually galvanized.

**10. Siding:** Siding nails are available for simulated masonry, wood and hardboard siding. Heads are flat except for the hardboard nail, which has a countersunk head. This nail is made of a stiff grade of steel to resist bending. All siding nails are galvanized.

**11. Underlayment:** This is a ringed nail with a small, flat, coun-

tersunk head and a diamond point. It's used to install plywood or untempered hardboard subflooring to joists.

**12. Upholstery:** Upholstery nails have a large, round or decorative head and are used to fasten upholstery. They are usually colored or plated so that they have an attractive appearance.

### Choice of metals

All the nails described above are made of steel, but other metals are also used for making some types of nails, including aluminum, brass and copper.

It is important for you to match the nail to the metal you are working with. This prevents the problem of galvanic corrosion that results when dissimilar metals are brought into close contact. **PM**



When a common nail (left) splits thin stock, a smaller-diameter box nail of equal length (right) will do job without splits.



Blunt-pointed, cut flooring nails minimize splits in flooring tongues. Use a blunt nail-set to set all nailheads flush.



Drive hardened masonry nails into mortar joint using at least a 20-oz. hammer or a hand mallet. Since these nails chip and break easily, wear your safety goggles.



Nongalvanized or poorly galvanized nails will rust and stain siding. Eventually, disintegrating nailheads will lose holding power, causing the shingles to loosen.



Corrugated fiberglass or metal-sheet roof materials are best attached with neoprene-washed nails. These will effectively prevent water leaks. They are ringed and available in aluminum and galvanized steel.



When gluing up workshop projects that are difficult to put clamps on, use finishing nails to secure joints as the glue dries.



Choose cement-coated nails for installing wall-panelling molding strips, since they won't loosen to cause problems later.



Choose hot-dipped, galvanized common nails for outdoor wood construction to prevent the corroding effect of the weather.



Assemble temporary structures with double-head (scaffold) nails. Used on this saw-horse cross member, they are easily pulled to permit folding and flat storage.



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## BUILD A CUPOLA

(Continued from page 109)

rag. Hold the face of the soldering tip flush on the work to transfer maximum heat.

After soldering, use a file to smooth out any irregular lumps. Occasionally rub chalk in the file teeth to minimize clogging.

Use soapy water with a small amount of vinegar added to wash off the flux from the surface.

The bottom edges of the copper roof panels (R) will overhang the roof side pieces (S,T) by about  $\frac{3}{8}$  in.

Apply caulking along these bottom edges of the copper where they meet the crown molding (U).

### Weather vane bracket

The standard attachment bracket supplied with many weathervanes could not be used on this cupola roof, due to its sharp peak. However, you can shape a bracket (W) of  $\frac{1}{8}$ -in. aluminum stock.

Form the slight curves by cutting the bracket strips through scrap 2x2. Sandwich the aluminum between the wood and squeeze the assembly in a vise. Make the sharper

bends by hammering the aluminum against an anvil or machinist's vise.

### Finishing the cupola

Paint all of the exposed surfaces. However, leave the insides of the shutters bare so the wood can breathe to protect against decay.

Assemble the unit completely at ground level to check fit; then disassemble the roof, shutters and base facing boards to lighten the load for transporting the cupola to the roof of the house.

If your house roof is of truss construction (like the one shown in this installation), simply cut a 22-in.-square hole through the ridge. For a conventionally framed roof with a ridge board, see *How to Make Room at the Top* (page 180, Feb. '80) for details on framing an opening through a ridge.

See the photos on page 107 for details on installing the cupola.

After the cupola is attached to the house roof, aluminum flashing is installed and the face boards are nailed. Next, secure the copper roof. Finally, install the shutters (V) and nail center cleats (X) to brace the shutters at the joint line. Use a compass to locate true north for positioning the weathervane. **PM**



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### MATERIALS LIST—CUPOLA

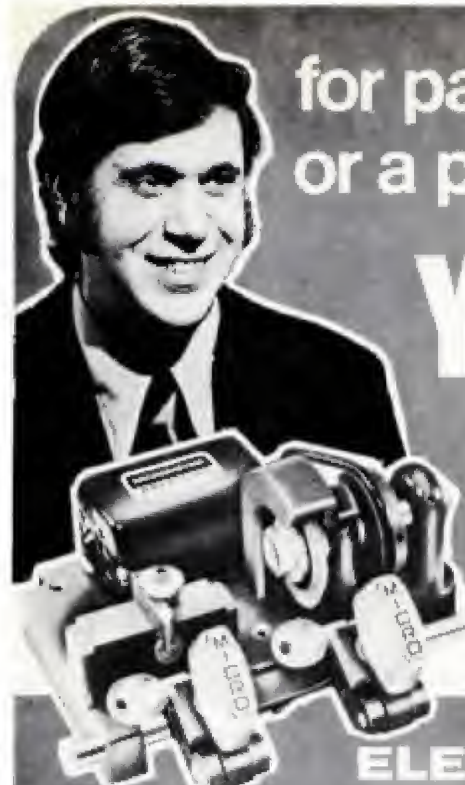
Key	No.	Size and description (use)
A	4	1½ × 1½ × 30" kiln-dried fir (headers)
B	4	1½ × 1½ × 28½" kiln-dried fir (corner posts)
C	4	1½ × 1½ × 27½" kiln-dried fir (soleplates)
D	4	1½ × 1½" to suit roof slant, kiln-dried fir (braces)
E	2	1½ × 1½ × 37½" kiln-dried fir (roof frame)
F	2	1½ × 1½ × 34½" kiln-dried fir (roof frame)
G	2	1½ × 1½ × 27½" kiln-dried fir, beveled to roof pitch (anchor braces)
H	4	1½ × 3¼ × 7½" fir (peak support blocks)
I	4	¾" Champion Building Products texture 1-11 plywood cut to fit (facing)
J	4	1¼ × 3¼ × 32" pine (sills)
K	1	¾ × 37½ × 37½" plywood (roof base)
L	8	1½ × 1½ × 20½" kiln-dried fir (vertical rain stops)
M	8	1½ × 1½ × 24" kiln-dried fir (horizontal rain stops)
N	2	¾ × 6¼ × 31½" plywood (sheathing)
O	2	¾ × 6¼ × 32¼" plywood (sheathing)
P	2	¾ × 14½ × 48½" plywood (roofing formers)
Q	4	1½ × 29" 16-oz. cold-rolled copper sheet (former strips)
R	1	3 × 6 ft., 16-oz. cold-rolled copper sheet (4 roof panels; locate position of all panels on copper before cutting)
S	2	¾ × 2½ × 34½" pine (roof side pieces)
T	2	¾ × 2½ × 39" pine (roof side pieces)
U	4	1¼" solid crown molding (edging trim)
V	8	15 × 24" presanded shutters, trimmed to fit (see note 1 below)
W	2	¾ × 5" aluminum stock (weathervane brackets)
X	4	½ × 1½ × 19½" pine (cleats)

**Misc.:** Hot-dipped, galvanized 8d common nails; hot-dipped, galvanized 10d finishing nails; 4, 3" No. 14 fh wood screws; 1" No. 10 pan-head, stainless-steel screws; ¾ × 4" No. 18 lag-screws and washers; 4, ½ × 1½" corner braces; 2 pair of 1-½ × 2" solid brass hinges; 1" brass or copper escutcheon nails; plastic resin or resorcinol glue; aluminum flashing; aluminum screening; exterior paint.

**Note 1:** Shutters are available from J.C. Penney, item No. A-737-3731 A; trim them to 13½ × 20-1½".

**Note 2:** Weathervane with three-dimensional horse figure is available from J.C. Penney, item No. A-847-3530 A horse.





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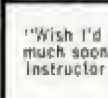
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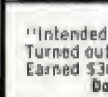
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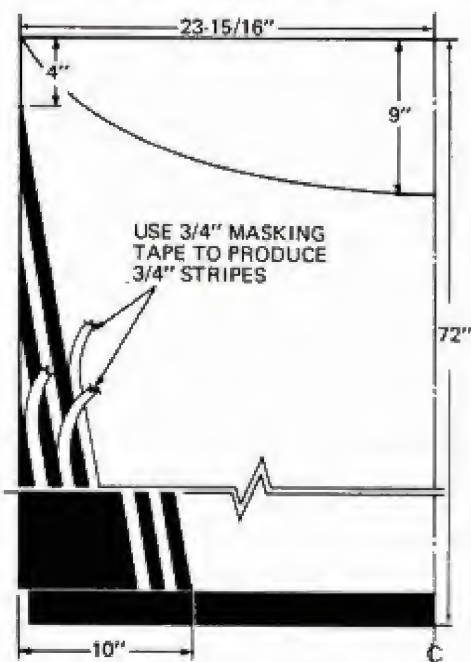
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glue  $\frac{1}{2} \times \frac{3}{4}$ -in. cleats to the sides and back at positions below the shelves and desk panel. (Top and bottom cleats aren't needed.)

Before starting the cabinet assembly, attach shelf stiffeners to the shelves and sand the raw edges. Also, cut the desk flap to size (slightly smaller than the main desk panel's width).

Because the continuous (piano) hinge is on the bottom surfaces, this is easier to install before assembly. Insert  $\frac{3}{32}$ -in.-thick shims between the flap and desk panel; tape hinge in place, mark hole centers with an awl and drill the screw pilot holes.

Assembly can be with white or aliphatic-type glue—if room temperature isn't too high and if you're used to working fast. Otherwise, use a slow-setting hide or animal glue to assure adequate working time.

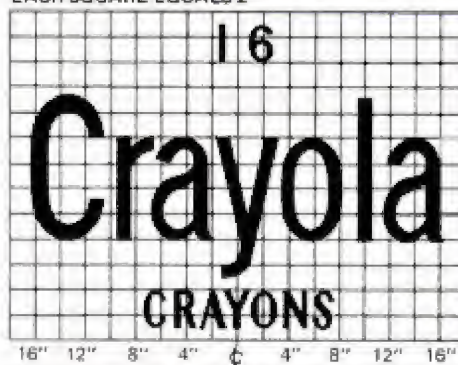
### Assembling the cabinet

Attach the shallow box to the bottom panel. Lay one side panel on two lengths of 2x4 (shimmed if the floor is uneven) so there will be no bouncing or rocking. Use parallel clamps to hold the shelves and desk panel upright. Add the top and bottom last. Lay the other side in place on the cross members and start a nail into each one.

Lift the side panel, apply glue to both surfaces and nail. Add the top and bottom; then remove the clamps below. With a strong helper, grasp both ends and flip the assembly over, being careful to keep the whole thing intact. Nail and glue the second side.

Lay the unit on the floor, back side up, and glue and nail in the back.

EACH SQUARE EQUALS 2"



### MATERIALS LIST—ULTIMATE DESK

Key	No.	Size and description use
A	1	$\frac{1}{2} \times 48 \times 72$ plywood (back)
B	2	$\frac{1}{2} \times 20 \times 72$ plywood (sides)
C	2	$\frac{1}{2} \times 20 \times 47$ plywood (top, bottom)
D	1	$\frac{1}{2} \times 8\frac{1}{2} \times 47$ plywood (shelf)
E	1	$\frac{1}{2} \times 8\frac{1}{2} \times 47$ plywood (shelf)
F	1	$\frac{1}{2} \times 15\frac{1}{2} \times 47$ plywood (shelf)
G	2	$\frac{1}{2} \times 2\frac{1}{2} \times 18$ pine (base sides)
H	2	$\frac{1}{2} \times 2\frac{1}{2} \times 47$ pine (base ends)
I	2	$\frac{1}{2} \times 11 \times 12$ plywood (flap supports)
J	1	$\frac{1}{2} \times 4\frac{1}{2} \times 47$ plywood (light shield)
K	2	$\frac{1}{2} \times 23\frac{1}{2} \times 72$ plywood (door fronts)
L	4	$\frac{1}{2} \times 8\frac{1}{2} \times 72$ plywood (door sides)
M	8	$\frac{1}{2} \times 8\frac{1}{2} \times 22\frac{1}{2}$ plywood (door tops, bottoms, shelves)
N	2	$\frac{1}{2} \times 3 \times 18$ plywood (paper rack sides)
O	1	$\frac{1}{2} \times 3 \times 21\frac{1}{2}$ plywood (paper rack base)
P	2	$\frac{1}{2} \times 3$ -dia. plywood (paper roll rod discs)
Q	2	$\frac{1}{2} \times 14\frac{1}{2} \times 18$ plywood (bench sides)
R	1	$\frac{1}{2} \times 11 \times 18$ plywood (bench seat)
S	2	$\frac{1}{2} \times 14\frac{1}{2} \times 18$ plywood (bench step, bottom)
T	2	$\frac{1}{2} \times 2\frac{1}{2} \times 18$ pine (bench step stiffeners)
U	2	$\frac{1}{2} \times 3\frac{1}{2} \times 7$ plywood (crayon holder sides)
V	1	$\frac{1}{2} \times \frac{3}{4}$ x to fit, pine (cleats)
W	1	$\frac{1}{2} \times 18\frac{1}{2} \times 47$ plywood (desk)
X	1	$\frac{1}{2} \times 12 \times 46\frac{1}{2}$ plywood (desk flap)
Y	2	$\frac{1}{2} \times 1\frac{1}{2} \times 3$ pine (desk flap stops)
Z	3	$\frac{1}{2} \times 1\frac{1}{2} \times 47$ plywood (shelf stiffeners)
AA	1	$\frac{1}{2} \times 7\frac{1}{2} \times 8\frac{1}{2}$ (crayon rack)
BB	1	$\frac{1}{2} \times 13\frac{1}{2} \times 22\frac{1}{2}$ plywood (paper rack, front)
CC	1	$\frac{1}{2} \times 19 \times 22\frac{1}{2}$ plywood (paper rack, back)
DD	1	$\frac{1}{2} \times 6\frac{1}{2} \times 8\frac{1}{2}$ plywood (crayon holder backup)
EE	2	$\frac{1}{2} \times 18\frac{1}{2} \times 22\frac{1}{2}$ Peg-Board
FF	4	$\frac{1}{2} \times \frac{3}{4} \times 18$ pine (trim)
GG	4	$\frac{1}{2} \times \frac{3}{4} \times 22\frac{1}{2}$ pine (trim)
HH	4	$1 \times 2 \times 18\frac{1}{2}$ furring (Peg-Board support)
II	4	$1 \times 2 \times 19\frac{1}{2}$ furring (Peg-Board support)
JJ	2	$\frac{3}{4} \times \frac{1}{2} \times 12$ hardwood (flap levers)
KK	1	$\frac{1}{4}$ -dia. x 22 $\frac{1}{2}$ dowel (paper roll holder)
LL	2	1"-dia. x 11" dowel (handles)
MM	4	$1 \times 1\frac{1}{2} \times 1\frac{1}{2}$ , cut from 2 x 3 fir
NN	1	18 $\frac{1}{2} \times 45\frac{1}{2}$ Homasote
OO		5-mm x 18 $\frac{1}{2} \times 46\frac{1}{2}$ roll cork
PP	4	1" x No. 10 fl. screw, countersunk washer
QQ	2	1 $\frac{1}{2} \times 72$ continuous hinge
RR	2	1 $\frac{1}{2} \times 11$ continuous hinge
SS	1	1 $\frac{1}{2} \times 46\frac{1}{2}$ continuous hinge
TT	2	Shepherd No. 9019 Nola, 2 $\frac{1}{2}$ " ball caster
UU	2	Amerock T 9700 door catch
VV	2	Screw eyes
WW	1	5' cord
XX	9	Clothes pins
Y1	1	36" single fluorescent lamp fixture
Y2	1	Lamp cord and plug
Y3	1	$\frac{1}{2}$ " hex nut
Y4	1	$\frac{1}{4}$ " cord bushing
Y5	3	Solderless connectors
Y6	1	Pull chain switch

The predrilled lead holes will keep the nails on target. Set all nailheads and fill.

Next, do the doors. Because of their smaller size, you don't need cleats for the door assembly. However, work the same as with the cabinet: Mark, drill and use clamps to position and hold parts upright.

Hinge-fit the doors next. Lay the

cabinet on its back and attach the hinges to the sides. Tape cardboard shims about  $\frac{3}{32}$  in. on the edge adjacent to the hinge and position the doors in position. Mark the screw centers and bore pilot holes. (Note: Due to the hinge placement, clearance isn't required at the center where doors meet. However, a  $\frac{1}{8}$ -in. clearance is indicated in the plans to prevent binding problems that could occur if the cabinet twists on an uneven floor.)

Hinged desk-flap supports must be positioned slightly lower than the flap to clear the hinge knuckle. Solid wood strips attached to the bottom surface of the flap make up the offset.

Nail Peg-Board inserts in the doors to 1x2 standoff strips to provide back clearance for the hooks. Cut thin wood strips,  $\frac{1}{4} \times \frac{3}{8}$  in., to dress the inside corners around the perforated board, but do not attach them until after painting.

To make the cork bulletin board, roll cork is contact-cemented to Homasote fiberboard. Trim the board to size after the cork is laminated. Use flathead screws and finishing washers to attach it after painting.

The novel crayon-shaped handles can be turned on a lathe or you can make them with a disc sander. Using the simple jig shown, feed the dowel slowly against the disc while rotating it continuously.

To drill holes in the crayon holder, assemble it without the permanent  $\frac{1}{8}$ -in. bottom panel in place (use a temporary one for backup). Mark hole centers with an awl; then place the rack on a flat board on the drill-press table. A brad-point drill bit will enter the slanted surface readily without slipping or drifting.

After sanding the raw edges, give the entire cabinet a coat of primer; then paint it. To color-match the Crayola box, we used PPG No. D 4213 Sardonyx and No. N 7914 Lacquer Green. Desk and bench were coated with No. U 7245 Really Rust. Use masking tape for a sharp border between colors. Paint trim strips around the perforated-hardboard panels and attach them with  $\frac{3}{4}$ -in. brads.

To letter the box, make a full-size template as shown in the plans. Tape this on the box with pencil carbon beneath. Redraw the lines, using a straightedge and sharp pencil to transfer the logo. Use the green paint to fill the lines.

For a tough finish that you can wipe clean with water, let the paint cure several days, and then apply varnish as it comes from can. **PM**



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Tommy Dillon, a mechanic of 25 years in High Point, North Carolina has perfected a method of converting V-8 engines into V-4's. His first conversion was on a 400 cu. in. 1975 Dodge Monaco, and the gas mileage jumped from a costly 12 m.p.g. to an amazing 26.4 m.p.g.!

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According to Mr. Dillon, the change in the performance of both cars, other than the increase in gas mileage, was negligible at speeds over 30 m.p.g. with only a slight loss of power in acceleration.

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Cold-weather cyclist wears a helmet, face mask, scarf, reflective vest, glove liners and mittens, long underwear and low-heel boots. Mixte frame allows for comfortable riding in skirts. On her bike are generator-powered lights, a warning bell on left handlebar grip (see inset), fenders, air pump, toe clips, reflectors, rear carrying rack, lock, panniers and anatomical seat.

## BICYCLE COMMUTING

(Continued from page 95)

along with a toolkit, rain poncho and other cargo, a wide range of products is available. Most, like handlebar bags and rear panniers, are borrowed from bike touring. Some of the gear can double as luggage.

As with every other popular phenomenon, biking has fostered its own high fashion. New garments for inclement weather should be of prime interest to commuters. While old standbys like folding ponchos still find plenty of favor, good-looking outerwear made of Gore-Tex provide superb weather protection for those who can afford it. Jackets, pants and gaiters made of the stuff keep you dry but still "breathe."

Safety equipment has improved, too. Jackets and pants (and even panniers) coated with a substance called Early Warning transform the bike rider into a giant reflector at night. Rear-mounted flashing lights also improve nighttime visibility.

Rider comfort hasn't been ignored either. Foam or leather padding for handlebars all but eliminates hand numbness during long rides. And so-called anatomical seats have replaced the traditional hard-leather saddle in many cycling circles.

If bike commuting makes so much sense, why isn't everyone doing it? There are many valid reasons, but all of them can be dealt with. Here's how to overcome the most commonly cited obstacles.

**Advanced age.** Provided your doctor doesn't object, there's nothing to keep any healthy person from riding a bike for all but the longest dis-

tances. Bike commuting isn't a race, so speed isn't important.

**Poor physical condition.** Again, given a doctor's okay, cycling is not only possible for out-of-shape riders, it provides an easy way to improve physical condition. Many experts believe cycling to be better exercise than jogging because the smooth pedaling motion doesn't abuse the legs like the constant pounding of running. Further, cycling is done sitting down, making it less fatiguing.

**Too long a commute.** Most people can manage 10 to 12 mph on a bicycle for long periods; 15 or 20 mph becomes easy with experience. Even a 10-mile commute would take an hour at most. Depending on where you live, that could be faster than public transit or car.

Most car engines take a good seven miles to warm up. That means short trips result in more pollution, higher fuel consumption and greater engine wear than does highway cruising—so save the car for long trips.

**Inferior bicycle.** Commuters use every kind of bike imaginable—1, 3, 5, 10, 12 and even 15-speed bikes, folding bikes and three wheelers. It's not necessary to have an expensive 10-speed, although many people do. If your commute is relatively flat, almost any bike will suffice. For gentle hills, the low gear(s) of bikes with three or five speeds should do. Many long-time commuters use such bikes. For extensively hilly riding, a 10-speed may be necessary.

**Bad weather.** Many dedicated commuters don't bike in rain and snow.

(Please turn to page 148)



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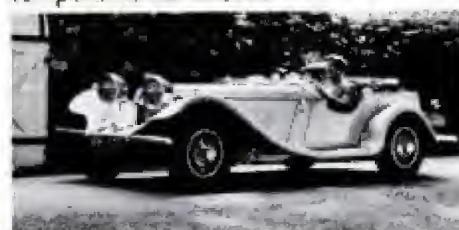
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## BICYCLE COMMUTING

(Continued from page 146)

It's unwise when there's much ice on the road. But riding in bad weather is not a trial, especially with new riding wear available.

**Dirt and perspiration.** Afraid you'll be sweaty and grease-covered after a bike ride to work? Well-dressed executives who commute by bike report fenders and leg straps are usually enough to keep you clean. With experience, it's easy to know how much clothing to wear. That usually means being just a bit cool upon departure so you warm up as you ride. Some commuters change clothes at work; a number of firms provide shower facilities.

**Safety problems.** Bike riding in traffic can be dangerous. But statistics show most cycling accidents involve young or inexperienced riders riding improperly or without sufficient light at night. A few precautions can eliminate most dangers:

■ **Always wear a helmet.** Even a low-speed collision could be fatal without head protection. A helmet may look funny and cost a lot, but scrambled gray matter looks worse and costs more to fix—if it can be fixed.

■ **Always ride with traffic.** Unlike pedestrians, cyclists should always "go with the flow" of traffic. Wrong-way cyclists cause innumerable accidents because no one expects them to come riding along from the wrong direction.

■ **Wear white at night.** Plaster your bike with reflectorized tape. Wear leg or arm lights or put a light on front or rear of the bike, or both. See and be seen.

■ **Ride prudently.** Obey the traffic laws—don't sail through red lights and stop signs. Don't weave crazily through traffic or cut off people. Ride several feet away from parked cars to avoid a suddenly opening door. And hand signal when turning.

■ **Keep your bike in shape.** A bike with bad brakes or loose nuts is an accident waiting to happen (see *Tune Up Your Bike For Riding Ease and Safety*, page 118, July '79).

**Bike Security.** Always lock up your bicycle. Many riders have psyched themselves past every possible objection to bike commuting only to have their bike damaged or stolen the first week. The long-term answer is employer cooperation to provide secure bike racks or even allow commuters to bring bikes into their factories and offices. Otherwise, the best bet is a U-shaped bike lock, posts and trees—and take your front wheel with you.

PM

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# POWER TO CAMP OUT OR SHIP OUT.

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## PORTABLE POWER.

The new EM-500 portable generator is the ideal companion for campers and hunters. It gives you a maximum 500 watts of power in a lightweight 40 lb. package about the size of a portable TV.

Whether you need to power your camping accessories, charge your RV battery or just warm-up under an electric blanket, the EM-500 does it quietly and economically—about 4 hours on a tankful of gas.

It's great for small power tools, barbecue motors and electric fans, too. And it can really light-up a camp site.

In addition to the EM-500, Honda has a full line of portable generators from 400 to 4,500 watts.



## NAUTICAL POWER.

Honda has power for boaters and fishermen, too. A line of 4-stroke outboard engines that come in 7.5 and 9.9-hp models, both with short or long shaft.

Honda's 4-stroke design means quiet operation. Quick response and powerful acceleration. Maximum fuel economy—over three hours on a tankful of fuel under full throttle.



Smoother operation. And less pollution because there's less oil and smoke discharge.

These engines are ideal for trolling. They have the power to keep from drifting at low RPM's without fouling the plugs.

Before you head out on your next trip, let your nearby Honda dealer tell you about Honda power. Just look in the Yellow Pages or call toll-free 800-648-5311 (Operator 99).

## IT'S A HONDA

©1980 American Honda Motor Co., Inc. For optimum performance and safety we recommend that you read the owner's manual before operating the unit.



excellent. Again, that's a cut above the American average, and proves that Chrysler Corp. is, indeed, trying hard to improve its total image on the grass-roots-owner level.

"I needed three transmissions in my 1978 Dodge Magnum, but haven't had any mechanical problems in my 1980 Mirada," stated a self-employed Wisconsin owner.

A Michigan store manager: "The wipers didn't work when I first tried them. The dealer changed the wiper motor in a half hour flat, and I didn't even have to get out of the car."

On the topic of general workmanship, the Mirada again received a hearty pat on the back, with nearly 80 percent in our survey rating it *good to excellent*. That's another healthy endorsement and, quite frankly, a radical change from our previous Chrysler Corp. reviews.

A Tennessee real estate agent: "Excellent workmanship. Quality superior to any car in its price range, in my opinion."

An Ohio CPA: "The doors and windows fit better than on other cars, making for less wind noise at highway speeds."

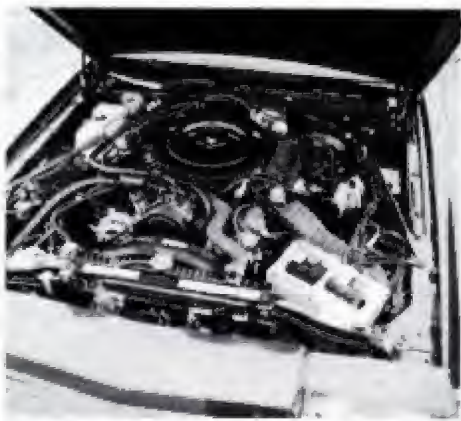
The Mirada's handling came in for another round of praise. "It's a peach to drive, and my wife agrees," declared a

sheet-metal worker from Arizona.

An Ohio pressman: "Great handling and maneuverability. I'm very pleased, too, with the acceleration and passing ability of the 225-cu.-in. Slant Six."

A Wisconsin RN: "Lots of get-up-and-go with the 318 V8." And you'll note in our data panel that only 0.8 percent of our respondents opted for the 360-cu.-in. V8, meaning that economy takes precedence over brute acceleration.

In the area of changes-we'd-like-to-see, here's a random sampling.



Most owners got the 318 V8; less than 1 percent ordered the 360-cu.-in. engine.

"Remove the fake louvers on the front fenders," suggested a Florida architect. And on the topic of styling, 8.1 percent of our respondents felt that the taillamps looked too rectangular and, as one person put it, "corny."

"How about a four-speed manual transmission to go along with the sporty look?" queried a Texas store clerk.

An Alabama chemical operator: "The rear swaybar ought to be standard equipment on this type of car, no matter which engine you choose." (In fairness, a heavy-duty suspension package is available for \$28 extra. The Open Road handling group costs an additional \$224. The Open Road package consists of front and rear stabilizer bars, alloy wheels, steel-belted radials and higher-effort power steering.)

A Michigan police officer: "The gas filler should be taken off the rear fender and hidden behind the license plate."

An Ohio salesman: "The front seats offer no thigh support."

And a South Carolina deliveryman: "The rear quarter windows ought to open up for better ventilation."

But the vast majority preferred to leave their Miradas just as they are. The following are the feelings of most owners.

New from Stewart-Warner

# Mini-Panel

The world's smallest instrument panel alerts you to car problems before they cause costly damage.

Mini-Panel is the miniaturized early warning system that helps you spot problems that develop while you drive. (Unlike traditional warning lights that don't go on until it's too late.) Catch those problems early, and you'll save yourself a lot of grief, as well as expense.

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It's easy to install\* with no drilling or bolting. No unsightly wires, so you have a professional-looking installation.

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\*Mini-Panel fits U.S. made AMC, Chrysler, Ford and GM vehicles; adapters are available for most imports.



"It's a beautiful, stylish car with lots of room," commented an Ohio educator. "I have nothing but good things to say about the Mirada. For example, my husband is very tall and this is the first car in which he's been able to sit up straight. It's very comfortable on long trips, and we're delighted with the Slant Six's excellent gas mileage. We're getting about 22 mpg in the city and 28 on the road."

And finally, from a Texas party-store manager: "The dealer had my car in tip-top condition when I took delivery. I watched him check it out from bumper to bumper."

Everything about the car fits well. There are no rough areas anywhere. I also like the large interior. There's plenty of roominess without everyone having to cuddle up. Plenty of space in the trunk, too. The

car handles great in tight situations, also in curves, parking and passing. I appreciate the maneuverability, the silence and the gas mileage. The mileage might seem average for a four-passenger car, but when you consider that it's possible to carry six people in the Mirada, the mpg is absolutely outstanding. I think it's one of the finest cars Chrysler Corp. has ever made." **PM**

## SUMMARY OF 1980 DODGE MIRADA OWNERS REPORTS\*

<b>Total miles driven</b> 475,456	Comfort . . . . . 37.2	Very good . . . . . 25.0	Good . . . . . 27.7
<b>Average miles per gallon</b>	Ride . . . . . 29.5	Good . . . . . 11.8	Average . . . . . 11.8
225-cu.-in. Six . . . . . 17.1	Economy . . . . . 23.3	Fair . . . . . 2.9	Fair . . . . . 7.6
Long trips . . . . . 22.7		Poor . . . . . 0.7	Poor . . . . . 8.4
318-cu.-in. V8 . . . . . 14.7	<b>Specific dislikes:</b>	<b>Comfort opinion (rear seats):</b>	<b>Number of vehicles owned:</b>
In town . . . . . 14.7	No complaints . . . . . 38.2%	Excellent . . . . . 41.3%	Mirada only . . . . . 52.6%
Long trips . . . . . 20.0	Mileage less than expected . . . . . 11.4	Very good . . . . . 33.9	Two cars . . . . . 35.0
360-cu.-in. V8 . . . . . 8.8	Noises and rattles . . . . . 8.1	Good . . . . . 15.7	Three cars . . . . . 9.5
(Sample too small to tabulate.)	Poor dealer service . . . . . 5.7	Fair . . . . . 6.6	Four or more cars . . . . . 3.0
<b>Engine choices:</b>	Poor workmanship . . . . . 4.9	Poor . . . . . 2.5	<b>Makes of other cars owned:</b>
225-cu.-in. Six . . . . . 36.4%	Cold starts . . . . . 4.9		Dodge . . . . . 32.3%
318-cu.-in. V8 . . . . . 62.6	<b>What changes would you like?</b>	<b>Had any mechanical trouble?</b>	Plymouth . . . . . 13.8
360-cu.-in. V8 . . . . . 0.8	No changes . . . . . 22.6%	No . . . . . 62.2%	Ford . . . . . 12.3
<b>Why did you choose the Mirada?</b>	Better gas mileage . . . . . 12.9	Yes . . . . . 37.8	Chevrolet . . . . . 10.6
Styling . . . . . 79.9%	Restyled taillamps . . . . . 8.1	<b>What type of trouble?</b>	<b>Age distribution of owners:</b>
Economy . . . . . 15.7	Better materials . . . . . 5.6	Cold starting . . . . . 19.6%	15-29 years . . . . . 25.1%
Size . . . . . 12.7	Different seat shape/style . . . . . 5.6	Carburetor . . . . . 15.7	30-49 years . . . . . 43.0
Price . . . . . 10.4	<b>Workmanship opinion:</b>	Transmission . . . . . 9.8	50-plus . . . . . 32.0
Handling . . . . . 10.4	Excellent . . . . . 32.1%	Windshield wipers . . . . . 7.8	<b>Would you buy another Dodge product?</b>
<b>Specific likes:</b>	Good . . . . . 47.4	<b>Dealer repairs satisfactory?</b>	Yes . . . . . 67.3%
Styling . . . . . 72.1%	Average . . . . . 13.1	Yes . . . . . 70.7%	No . . . . . 12.7
Handling . . . . . 36.8	Fair . . . . . 5.1	No . . . . . 29.3	<b>Would you buy another Mirada?</b>
	Poor . . . . . 2.2	<b>Dealer service opinion:</b>	Yes . . . . . 86.0%
	<b>Comfort opinion (front seats):</b>	Excellent . . . . . 44.5%	No . . . . . 14.0
	Excellent . . . . . 59.6%		

\*Percentages might not equal 100% due to rounding or insufficient data.

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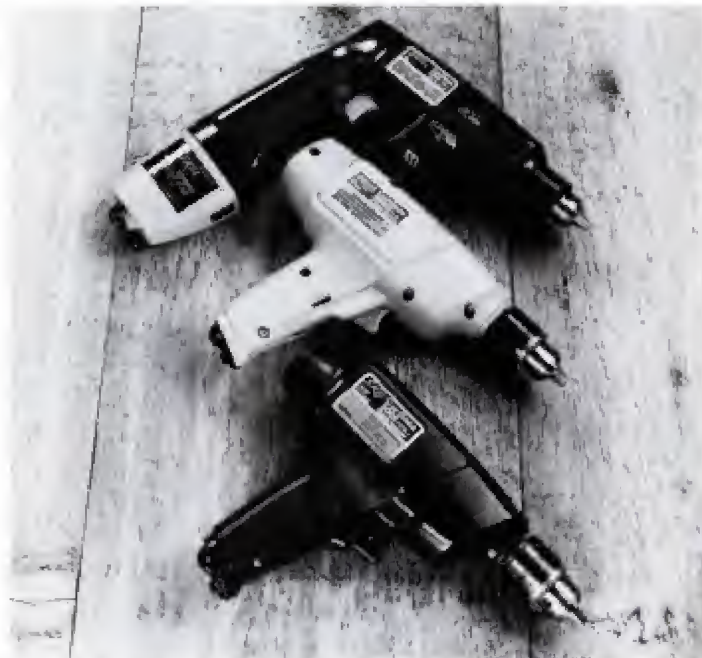
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\* Only the deluxe Model 2290 has adjustable height.

Manufactured in accordance with ISO 9001:2000



## 500 MILES ON 15 GALLONS

(Continued from page 83)

try. All this, mind you, is on a modest 80 hp from a small Continental A-80 powerplant (other engine options range from 65 to 85 hp).

How did George do it? He did it in part by borrowing liberally from the high-technology engineering developed by Burt Rutan for use in the now-famous VariEze (*VariEze: A Plane That Lives Up to Its Name*, page 74, Feb. '76) and Quickie (*PM's Pick: 10 Sports Planes You Can Build Yourself*, page 116, Feb. '79). Like the Eze and Quickie, Adventure is of all-composite construction using foam/fiberglass/epoxy laminations to build up wings, spars, fuselage, tail surfaces, even landing-gear struts. The method produces an incredibly strong, light, glass-smooth airframe capable of high performance on low power.

Mead's choice of composite construction is not surprising. A flight-test engineer for Cessna and former Air Force pilot, George worked with Burt Rutan during the final development stages of the VariEze, where he became convinced that the simple, moldless, foam/glass/epoxy process was the modern way to go. He found that many prospective sports-plane builders also liked the process, but wanted something not quite so far out as the canard-wing Eze or tandem-wing Quickie. He thus set out to see how the exotic Rutan mystique could be applied to a traditional-looking aircraft.

Enter Adventure, a sort of Ford built on a Ferrari chassis, uncannily quick and agile, but conservative in appearance. This is intentional and a major selling feature. In fact, George is billing the Adventure as "the first design to offer true sandwich composite structure in a conventionally configured airplane."

### Docile but not dowdy

Most midget racers have short, stubby, low-aspect-ratio wings and tails, sacrificing some lift and stability for speed. Mead went in the opposite direction. Though only 13 feet long, his Adventure has a broad wingspan of 20 feet and a somewhat oversize tail group. Both wing and tail surfaces are of a graceful, thinly tapering, high-aspect-ratio shape—almost sailplane-like. Mead believes this is necessary for good lift, sure-footed stability and safe, easy handling. The large tail is designed to dampen out up-and-down pitching—a problem that typically plagues many small planes.

The result is a craft that's docile without being dowdy. "It's the kind

of airplane," says George, "that if you don't like what you are doing, you can let go of the thing and it will behave itself."

### Racing the fuel gauge

In the classic Indianapolis 500, racing machines cover 500 miles in 2½ to 3 hours at speeds up to 200 mph. In the Oshkosh 500, racing machines cover 500 miles in 2½ to 3 hours at speeds up to 200 mph.

Apart from the fact that the Indy machines are cars and the Oshkosh machines are airplanes, there is one other important difference: The Indy racers consume up to 280 gallons of fuel, the legal maximum; the Oshkosh racers are limited to just 18 gallons for single-place planes and 22 gallons for two-seaters—up to 262 gallons less for the same distance.

The Oshkosh 500, officially known as the Lowers-Baker-Falck Competition, is a recently established event held annually at Oshkosh, Wis. Unlike other air races, it is a speed/efficiency contest in which the idea is to see how fast you can go on the least amount of gas—just to make things interesting. You thus race the fuel gauge as well as the clock.

George covered the 500 miles in two hours, 50 minutes and 17 seconds at an average speed of 176.32 mph—enough to win third place in a field of nine (famed professional race pilot Steve Wittman took first).

What's more significant, however, is that Mead used less fuel than any other contestant—a mere 15.1 gallons for an average of better than 33 mpg. (Wittman clocked 197.70 mph, but consumed 17.1 gallons.) Earlier, George flew 620 miles nonstop from Wichita, Kan., to Oshkosh on just 16 gallons for an average of nearly 40 mpg—not bad for a 180-mph-plus airplane.

### Light and lively

One reason for Adventure's speed and economy is its low weight—only 460 pounds empty. Yet gross weight is 780 pounds, providing ample payload for a good-sized pilot and 23 gallons of fuel in two tanks.

While the landing gear is fixed, the penalty in drag is minimal, Mead feels, compared to the weight, cost and complexity that a retract-gear system would impose. The main-gear struts are in the form of a single, continuously curving fiberglass bow—a slick innovation adapted from Rutan's VariEze that provides simple mounting and a self-springing action without an elaborate suspension.

A fighter-style side-stick control-

(Please turn to page 154)



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### THE EASY SHINERS.

## 500 MILES ON 15 GALLONS

(Continued from page 153)

ler is located in the right-hand cockpit console—another touch taken from the VariEze. Rutan and Mead are both convinced from their military experience that the modern side stick offers more precise control, better arm support and less fatigue.

### Clever cooling system

Most small planes merely have an opening in the nose to scoop in air and cool the engine, a method that works but at the cost of some speed-killing drag. Mead goes a step farther. His intake scoop is connected to a diverging duct that slows down incoming air while increasing its pressure. Thus the engine is bathed in high-pressure, low-velocity air for maximum cooling efficiency.

At the top of the engine, heated air is collected in a plenum chamber and channeled through a converging duct where it is accelerated back up to nearly its original inlet speed and expelled through an exhaust port. This highly effective flow of cooling air enables the intake port to be very small—about half the size normally used. Thus drag is likewise cut approximately in half.

The wings are built as two separate panels that merely "plug" into the fuselage through reinforced slots. Their single, massive spars carry through to the center and are joined by metal splice plates on the floor of the cockpit—that's all there is to the wing installation.

Long-span, slotted flaps extend from the wing root to the ailerons and deflect 15° for takeoff and approach and 45° for landing. Fully deployed, they reduce stall speed by 13 mph to a comfortably tame 57 mph. Approaches can be made at 80 to 85 mph, with touchdown at around 60. Takeoff run is about 800 feet; landing roll, 1500.

Mead estimates his Adventure can be built for a bit under \$5000, allowing \$2000 for engine cost. Construction plans, including engine installation and operating manual, are \$100 from Mead Engineering Co., Box 354, Colwich, Kan. 67030. An info brochure is \$5. A complete materials kit is available at an introductory price of \$1980 from Aircraft Spruce & Specialty Co., Box 424, Fullerton, Calif. 92632. Hard-to-make items like axles, engine mount and other welded parts will be supplied by Ken Brock Manufacturing, 11852 Western Ave., Stanton, Calif. 90680. The plastic bubble canopy and landing-gear struts can be obtained from Mead himself.

PM

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# The inside of your engine



Piston rings scrape walls at up to a mile a minute, often at 1000° or more. Newer cars run hotter, require tougher oil.

Valve stems can reach 1000°. If the oil breaks down here, varnish and gum can form. The valve could stick.

Burning gas reaches 3000° and leaves behind dirt, which shortens engine life. The oil on these walls has to clean and survive.

Water drips off these walls at night—into your oil. When your engine isn't wearing out, it could be rusting out.

Acid attacks these bearings unless your oil attacks the acid first.

Crankcase oil must protect at -35° to over 300°. And it's not just oil down there. There's water, metal, acid, gum, sludge, rust, and other filth. In stop-and-go driving these things collect quicker, and the only way they get cleaned up is by the oil.



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The tough oil



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So why go on torturing yourself?  
Use Dr. Scholl's Foot Powder every day.



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## ROCKET BOAT

(Continued from page 75)

pretty hard to stop. That is what caused Taylor's crash in his craft, *Hustler*, at Lake Mead. He was running so fast that he simply ran out of water and ended up slamming against the side of a hill. Taylor's next ride in the *Hustler*, three years later, was slowed with a parachute, the first time one had been used to brake a boat. *Discovery II* will employ a dual Deist drogue-chute system, similar to those now used on drag boats and cars. The parachute, besides giving the pilot deceleration control, helps the boat avoid the sponson-jumping effect that caused the crash and death of Donald Campbell in his famous *Bluebird*, after Campbell had set seven records over a nine-year period.

A hull that will hold together at three times the force of gravity during tremendous acceleration and deceleration pressures is not easy to design. Lee Taylor has taken advantage of one of the latest aircraft technology advancements, a polyurethane bonding process that is applied much like spray paint and acts as a shrink-fit sealant. McDonnell Douglas and the U.S. Marine Corps, major developers of the system, have predicted that rivetless aircraft will be produced in a few years using this process. The *Discovery II* record attempt gives this innova-



Stern view, before engine was installed, shows long rudder that has only four inches in water when craft is on plane.

tion a major tryout, and standard rivets are used as well for added safety. Test with a model showed that the rivet/bonding made the craft capable of holding together under an astounding 20.6 Gs of force, more than anything likely during actual speed runs.

When you first see the boat, you're

(Please turn to page 160)





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## ROCKET BOAT

(Continued from page 158)

likely to say, "Put wheels on it and set a new land speed record at Bonneville." Taylor isn't interested. A water man, he contends the obstacles faced trying for boat records are much more numerous and dangerous than ashore—a reason no one tries very often for the water record. Taylor's 1967 record, set at Lake Guntersville, Ala. (285.213 mph in the *Hustler*), went unchallenged for 11 years. At Guntersville, the late German rocket expert, Dr. Wernher von Braun, was an adviser.

Taylor had been attracted to southern California water sports since his youth. Friendship with speedboat designer Rich Hallett kept Taylor on water skis or in a boat, and he held the water ski record, 92 mph, in the 1960s ("For about 10 minutes," says Taylor) behind a boat driven by Hallett. Lee later became one of the top drag racers, driving Hallett boats.

### A double rebuilding

Working with friends, and with the team spirit he had learned as a pro football player, it took Taylor a year to build his record-setting *Hustler*, and then another three years to rebuild it after his devastating Lake Mead crash. Lee also had to rebuild himself from what he calls "less than zero," including relearning to talk and walk. Taylor felt he owed much to the people who nursed him through the rough times after the accident, and was determined to try again. Fear is something he seems to have put in its place: "I've chased it down the street a long time ago. At over 200 miles an hour, you don't even have time to be scared."

What happened to *Discovery I*? The project just ran out of money, but the \$2.5 million effort of *Discovery II* with the support of Ducommun Metals and Sahara Tahoe appears ready for the test.

After the initial Tahoe record-go, Taylor plans further record attempts. Included are plans for a world tour, with record attempts on Lake Geneva, Switzerland, and perhaps Lake Baikal in the Soviet Union. After that, with a new and more powerful *Discovery III*, Taylor aims to take a waterborne shot at the sound barrier on Lake Tahoe.

These are no small plans, but they are from a man used to winning and determined to bring the prestigious speed title back to the United States. Lee Taylor is a man known for comebacks and success. With the *U.S. Discovery II*, he has a chance for both.

FM

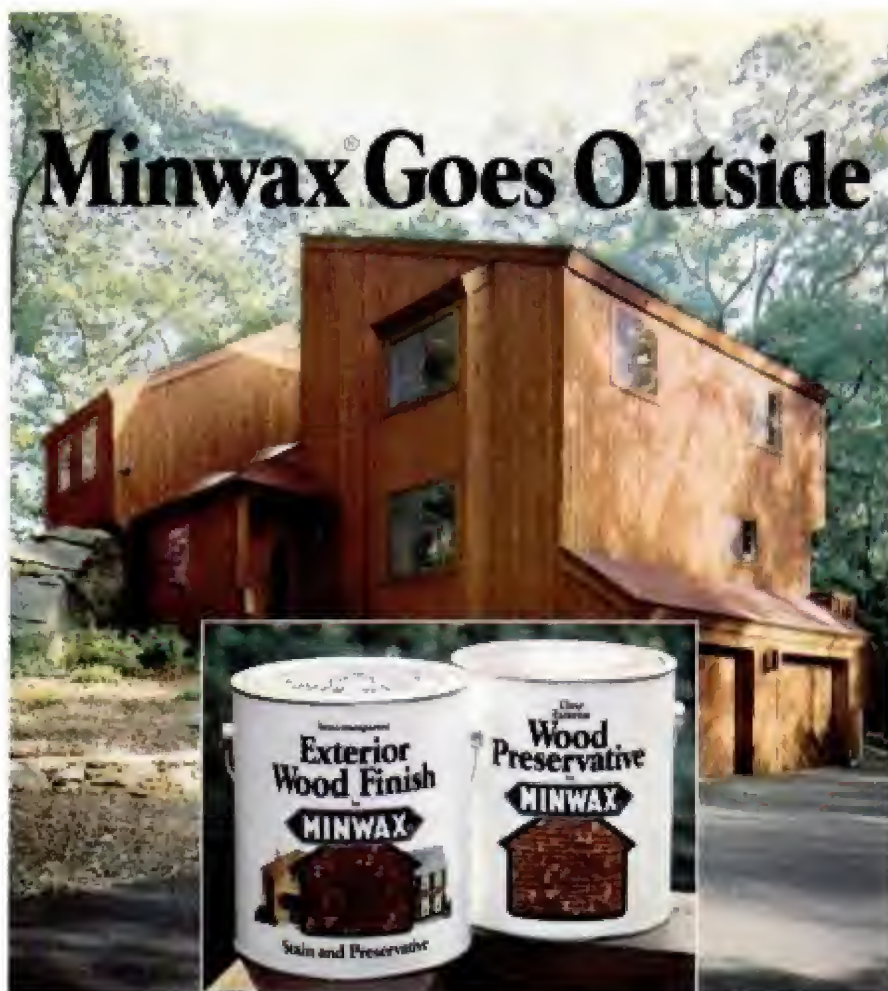




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## BUILDING A HUMAN HEART

(Continued from page 79)

the frustrating "early" experiments with total hearts—just seven years ago.

### The early operations

In a typical operation, doctors removed a calf's heart and implanted in its place two chambers driven by puffs of air in flexible pipes running through the animal's chest. One chamber was the left ventricle, fore-runner of the LVAD. The other, the right ventricle, received blood from veins and pumped it out to the lungs to take on oxygen before entering the left ventricle.

"We did six calves between 1973 and 1976," Pierce said, "and every one of the animals bled to death." Success came tantalizingly close in animal No. 6. While a contract officer from a federal funding agency watched, Pierce implanted the pumps. The calf's circulation appeared normal for about 15 minutes.

"Then," Pierce told us, "something very drastic happened. The aortic pressure fell and the inlet pressure rose, and we diagnosed that a disc on one of the valves had fractured." The calf was put back on the heart-lung support system, and was never weaned from it. The officer from the National Institutes of Health went back to Washington.

The Hershey team approached calf No. 7 with little hope that its funding would continue. "We put the pumps in, closed him up and expected something terrible to happen," Pierce said. "We put him in a cage in the care area and I came up here to get something from my desk, and then I went back down."

He was astounded by what he found. "The animal was *standing up*. We thought we'd better get pictures while we could, so we called in photographers." A crowd of them soon gathered around the cage, plugged in flash equipment—and blew the circuit breaker for the electrical line supplying the calf's pumps. The artificial heart stopped. The calf dropped in a quivering heap.

The situation called for heroic action: Two of the Hershey researchers disconnected the air hoses supplying power to the implanted pumps and began blowing into them, forcing the chambers to pump some blood into the calf's vessels with their own lung power. At the same time, others hastily found an extension cord and ran it from an outlet in another room to the pumping machine. Plugged back into the

(Please turn to page 164)



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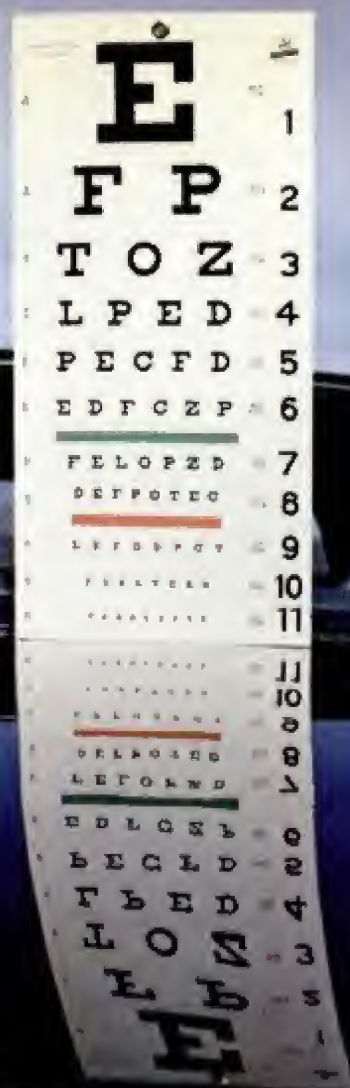
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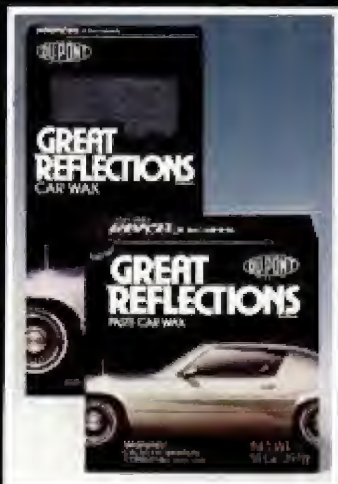




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## BUILDING A HUMAN HEART

(Continued from page 162)

external power, the animal survived.

From this shaky start, Hershey researchers have successfully implanted externally driven artificial hearts in more than a dozen calves; one of them lived 157 days. And over the last few years, they have begun to attack one of the central challenges facing all developers of mechanical hearts: building a motor small enough so the entire heart (except batteries) can fit in the chest.

### The \$1500 heart motor

The latest in a series of motors at Hershey weighs about 19 ounces (compared with a human heart's weight of roughly 12 ounces), takes up about the same space as a real heart and—in action—looks and sounds alive. In a working model of the motor in one of the Hershey labs, a chamber expands and contracts like an automated toy accordion. Pressing with two fingers on the chamber causes the heart to compensate for the extra load; it automatically resists the pressure, making whispered "whiff, whiff, whiff" sounds until pressure is released.

The works inside the heart are no more complicated than the inside of your car's engine. But the feedback and control systems are sophisticated. For one thing, the speed of the motor is regulated by a magnetically operated, solid-state switch built into the heart. As blood flows into the left polyurethane chamber, the chamber expands, thrusting a circular pusher plate sideways. A magnet at the center of this plate trips the Honeywell Hall-effect switch (see page 78) when the chamber is filled with blood. The filling time depends on blood pressure in the organism: the higher the pressure, the faster the fill—and the slower the heart should pump. So the Hall-effect switch enables the heart to "read" blood pressure continuously, and to pump at the right pace.

Initial versions of the motor weighed more than two pounds and cost around \$325, according to Dr. Gerson Rosenberg, a mechanical engineer who has worked on the design full time since 1975. Later versions cost more as they shed weight; the current model runs about \$1500.

### Hydraulic and atomic hearts

There's more than one way to build a heart, or keep it beating. At the University of Utah, Dr. Robert Jarvik is experimenting with an electrically driven hydraulic heart. A direct-current motor, operating at

(Please turn to page 166)





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your way through Ralph Nader and the whole world." The prognosis for atomic-powered hearts: They probably won't come into widespread use until after several years' experience with more conventional power, electricity or heat. And it'll be some years before doctors implant even conventionally powered hearts in human chests.

## The first patients

How many years? "People have been saying 10 years for 20 years," Pierce said. "I think we're farther away than 10 years." It depends largely on how the first LVAD implants work out; Pierce and others we interviewed were hopeful some human patients might begin wearing portable left-ventricle-assist pumps within the next four or five years. Jarvik's opinion: "The plan is to have LVADs ready about 4½ years from now, and the total heart could follow that closely."

And who will the first patient be? "The most obvious candidate," Pierce said, "is any patient who is now a candidate for heart transplantation. They only do 20 to 25 heart transplantations a year, and the need is for thousands a year."

The major problem with transplants is rejection: The body is programmed to cast out foreign proteins. But, ironically, the body won't reject the artificial plastic and metal hearts Pierce and others are building, because the mechanical versions are biologically inert.

So there is an eerie possibility that within a generation, for some patients who need a new heart, surgeons might pass up the real thing in favor of a custom-made, whirring, clicking machine. **PM**

## BUILDING A HUMAN HEART

(Continued from page 164)

about 8000 to 12,000 rpm, connects to the impeller of a flow pump. Fluid driven by the pump pushes against diaphragms, driving the blood. One advantage of the Jarvik unit: It weighs only about 14 ounces, not including the electronics. Jarvik expects to implant the self-contained heart in a calf before the end of the summer.

The Hershey heart and the Jarvik device require batteries; Rosenberg said patients with an artificial heart would probably have to carry a 12-pound battery pack whenever they were away from a wall outlet. Nuclear power offers one way to run an artificial heart without external batteries. One design under consideration at the Joint Center for Graduate Study at the University of Washington uses either an electric heater or a 1000° F. radioactive isotope—plutonium 238—to provide heat for a Stirling engine. The heat causes helium enclosed in the Stirling to expand, driving a piston and moving hydraulic fluid to power a pump for the blood.

The thermal engine would be convenient for patients who don't want to lug their power supply around. And several researchers we talked to said it was safe, locked up in a kind of Thermos bottle of foil insulation.

But lately, a number of lab sources told us, the idea of a nuclear-powered heart is about as popular as a mineral spa at Three Mile Island.

"The real advantage is you don't have to fool around with batteries, and it's better for the patient," one scientist said. "The disadvantage is you have to fight

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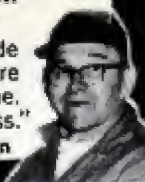
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## PM OWNERS REPORT: JEEP CJ-5 AND CJ-7 (Continued from page 101)

bearing—I give him a rating of excellent. Other minor problems, like carburetor stumble and a stuck vent, I'll fix myself. Workmanship ranges from excellent to poor—excellent for the big things like engine and drive train and poor for such items as dashboard mounting. What the Jeep needs is a bigger gas tank, tube-type tires, a manual choke, locking storage bins, higher seatbacks and a handier emergency brake. But I'd buy another one without hesitation when and if this one ever wears out."

A Michigan computer graphics designer, 22, owner of a CJ-7 V8 with four-speed and these comments:

"It's a fun machine summer and winter. I like to do more with my transportation than just go back and forth to work. I enjoy the V8's power, but it's mighty thirsty. I get about 12 mpg on the highway.

"I've had a couple of problems with my Jeep. The clutch adjustment screw loosened and made for hard shifting. The carburetor also used to bog down at freeway speeds.

"Comfort rates very good front and rear, but you have to remember that this is a short-wheelbase vehicle."

An Arizona electrical engineer, 23, with a CJ-5 Six and four-speed:



For serious off-roading, the windshield is able to fold down flat right over the hood.

"This is my second Jeep. I moved to Arizona from Kansas and decided to buy one with the options I need. I know I'm going to do a lot of off-roading.

"I've had no mechanical problems these first 4000 miles, and I love Jeeps because of their ruggedness, reliability

and simplicity. As for workmanship, I can see some cut corners—sloppy paint, bad undercoating, and so on, but it's got good quality in the major components."

A 39-year-old Michigan steelworker with a four-cylinder, four-speed CJ-5:

"I needed economical transportation and also wanted to have a toy. I hunt, so I figured the Jeep would make that easier.

"When I took delivery, the engine had a slight dieseling tendency, and one headlamp didn't work. The service department was prompt and efficient and also gave me some tips on maintenance.

"I like the Jeep's overall design, and its workmanship inspires confidence. The great range of accessories lets me personalize my vehicle. It's comfortable in both seats, but short people and kids could use a step to help get in and out. My specific praises of the Jeep are its ruggedness, looks and versatility. I wish they'd put a lockable storage compartment under the back seat."

And finally, an Oregon lineman, aged 60, with a CJ-5 Six and four-speed:

"I've owned Scouts, Broncos and Chevy 4x4s, but the Jeep is still king. Back in the '40s I always had the four-cylinder models; then went to the V6. And al-



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though I like the 304 V8, I went for the inline Six for 1980 and am delighted with its all-around performance and 14-to-18-mpg economy. I drive 68 miles five days a week, and my last 304 V8 was absolute murder on gas!

"I've purchased Jeeps in three different states, and all dealers were exceptionally good. Even so, I find that getting replace-

ment parts always takes 3 to 4 weeks. Of mechanical ills, the right front shock collapsed, and the clutch release bearing went out. Jeeps are famous for this. I've owned 21 Jeeps since 1946, and the defrosters have always been inadequate. The '80 model is no exception.

"That may sound negative, but you can tell I'm high on Jeeps. They're ruggedly

constructed, very easy to handle in tight rough spots, and have no rival in really brutal, off-road driving. It's amazing how much abuse they can take. I drive my Jeep in the rough every chance I get. In fact, in 1954 I lost one in a canyon. It's still down there! No questions, please. I made a bad mistake that day—but never a mistake buying any Jeep!"

PM

## SUMMARY OF 1980 JEEP CJ-5 AND CJ-7 OWNERS REPORTS\*

<b>Total miles driven</b> 771,465		<b>Recreational use</b> 10.5		<b>Comfort opinion (front seats):</b>		<b>Dealer service opinion:</b>	
<b>Average miles per gallon</b>		<b>Past experience</b> 9.9		Excellent 20.1%		Excellent 24.8%	
Ohrv Four (151-cu.-in., 2-bbl.)		<b>Specific likes:</b>		Very good 38.2		Good 26.1	
In town 17.5		Handling 37.6%		Good 25.1		Average 20.6	
Long trips 20.4		Styling 28.5		Fair 12.1		Fair 13.9	
Ohrv Six (258-cu.-in., 2-bbl.)		Roadability 22.6		Poor 4.5		Poor 14.5	
In town 14.0		Economy 19.9		<b>Comfort opinion (rear seats):</b>		<b>Number of vehicles owned:</b>	
Long trips 17.4		Performance 19.4		Excellent 6.9%		Jeep only 34.7%	
Ohrv V8 (304-cu.-in., 2-bbl.)		<b>Specific dislikes:</b>		Very good 27.7		Two cars 49.5	
In town 12.3		No complaints 17.0%		Good 28.0		Three cars 11.7	
Long trips 15.2		Gas mileage 17.0		Fair 24.9		Four or more cars 4.1	
<b>Engine choices:</b>		Noise and rattles 11.2		<b>Had any mechanical trouble?</b>		<b>Makes of other cars owned:</b>	
Ohrv 151-cu.-in. Four 31.5%		Stiff ride 9.0		Yes 60.0%		Ford 23.4%	
Ohrv 258-cu.-in. Six 54.8		Poor dealer service 6.4		No 40.0		Chevrolet 22.7	
Ohrv 304-cu.-in. V8 13.7		<b>What changes would you like?</b>		<b>What type of trouble?</b>		Oldsmobile 10.8	
<b>Transmission choices:</b>		No changes 16.7%		Clutch 28.2%		Buick 10.9	
Four-speed manual 91.1%		Better gas mileage 7.5		Shifter pin falls out 12.8		Volkswagen 7.0	
Three-speed automatic 8.9		Different seat shape 7.0		Transmission 12.0		<b>Age distribution of owners:</b>	
<b>Series choices:</b>		Larger fuel tank 5.9		Carburetor 11.1		15-29 years 59.2%	
Jeep CJ-7 52.0%		Different styling 5.4		Heater 7.7		30-49 years 36.2	
Jeep CJ-5 48.0		<b>Workmanship opinion:</b>		Oil leaks 7.7		50-plus 4.6	
<b>Why did you choose the Jeep?</b>		Excellent 31.3%		<b>Dealer repairs satisfactory?</b>		<b>Would you buy another Jeep?</b>	
Four-wheel drive 32.6%		Good 41.9		Yes 56.4%		Yes 89.4%	
Economy 23.8		Average 14.6		No 43.6		No 10.6	
Roadability 21.5		Fair 7.1					
		Poor 5.1					

\*Percentages might not equal 100% due to rounding or insufficient data.



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**DATSUN'S NEW 4x4 IN BAJA**

(Continued from page 93)

floods left us with four rivers to cross, plus innumerable streams and gullies that we had to tippy-toe through. The 14 pickups, each with a driver and passenger, were linked with CB radio.

Up at Mike's, which I can best describe as a well-stocked *cantina* that sleeps 40 (actually it also has a swimming pool, great *carne asada*, no phones and an abundance of solitude), off-road racer Jim Conner had laid out a course that included lots of soft riverbeds and sand.

We writers took turns tearing up the course and trying to tear up the Datsuns, but we failed on all counts. The 4x4s withstood all the abuse we could inflict on them—a great testimony to their ruggedness and overall quality of engineering and assembly.

**Converted from 2wd**

Basically, when you buy Datsun's new 4x4, you get the conventional pickup converted from two-wheel drive. Chassis, cabs, engines, transmissions and most other components are the same as the two-wheeler. So, you can go to any Datsun dealer or aftermarket accessory dealer and find parts, without having to worry about new-model stock shortages.

Front axles, independent front suspension, transfer case, axle ratios and the heft of some transmission gears in these Datsun 4x4s are new. They use torsion bars up front and overslung, heavy-duty, leaf springs aft, providing a payload capacity of 1400 pounds.

Also included in the 4wd package are 15-inch, all-weather tires on 5.5-inch wheels (radials on the King Cab); free-running front hubs; skid plates for the gas tank, catalytic converter and transfer case; front and rear towing hooks and an eight-inch ground clearance. Body mounts are about an inch taller than on Datsun's 2wd pickups, accentuating the tall look.

Inside, you get bucket seats (a bench is slated for later models), tach, voltmeter, oil-pressure gauge and 4wd indicator light. As in 2wd models, the Datsun 4x4s come in short- and longbed versions, with standard or King Cabs.

The King Cab boasts a five-speed overdrive transmission; standard-cab models use the four-speed. Air-conditioning, fancy interiors and several stereo options are all available in the new 4x4s.

Racer Jim Conner also sells two stages of off-roading equipment for



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these burros—equipment that most Datsun dealers stock. The first stage uses heavy-duty, single shocks and wider radial tires. The second stage offers twin shocks and competition tires. Also available are additional underbody protection and urethane fender flares.

### Driving these beastsies

Two things need to be improved in the Datsun 4x4. First, there's an awful lot of steering feedback from the big front tires. Several drivers ended up with skinned knuckles as a result of the steering-wheel being wrenched from their hands. Crawling over rocks and rills causes the wheel to want to go its own way. Datsun needs to offer power steering for these 4wd pickups—an option that's under consideration.

The second problem involves engine power and final gearing. The two-liter (1952 cc) sohc Four might be rated at 92 hp net, but it doesn't feel that strong on the highway.

At 55 mph, pulling 4257 pounds (unloaded) and a 4.375:1 axle ratio, there's just not enough power for comfortable passing in direct two-wheel drive. I piloted a standard-cab, shortbed Datsun 4x4 back from Valle de Trinidad to San Diego, Calif., got caught behind several trucks and just couldn't find long enough open stretches to pass. And on freeway upgrades, forget passing altogether.

The 4x4 does a fine job at low speeds in the rough, but how often does the average driver travel in Baja-like surroundings? Most likely, he'll spend 99 percent of his time on pavement, and that's where this 4x4 falls short.

I had no problem off-roading. The front hubs lock manually, which means you have to climb out of the cab to get at them. Fine—no quibble with that. The transfer case has four gear-lever positions: 2wd, 4wd high, neutral and 4wd low. In low range, the Datsun is willing, and often able, to tackle sheer cliffs, either up or down. Four-wheel-drive high gives good ratios for snow, mud and gravel roads.

All Datsun pickups come with reclining bucket seats, but the recliners can't tip back far enough in the conventional cab to let a driver really stretch his legs. In the King Cab, however, the seat does tip back far enough to give even tall drivers a comfortable driving position—and you can also order inward-facing, foldaway jumpseats for the kids.

The EPA says that these Datsun 4x4 pickups average from 19.9 mpg in the city to 27.3 mpg on the road, depending on which cab and transmission you choose. The King Cab, with its five-speed gearbox, yields better mileage than the rest, despite weighing slightly more than its shorter *compadres*. **FM**

### SPECIFICATIONS—DATSUN 4x4

Engine type: Sohc Four, cast-iron block, aluminum head.  
Bore and stroke: 85 x 86 mm or 3.35 x 3.39 in.  
Displacement: 1952 cc or 119.1 cu. in.  
Compression ratio: 8.5:1  
Net bhp @ rpm: 92 @ 5200.  
Net torque @ rpm: 112 @ 2800.

	4wd Shortbed	4wd Longbed	King Cab
Wheelbase	101.4 in.	110.8 in.	110.8 in.
Overall length	171.7 in.	187.0 in.	187.0 in.
Ground clearance	8.8 in.	8.8 in.	7.9 in.
Fuel capacity	13.2 gal.	16.9 gal.	13.2 gal.
GVWR	4257 lbs.	4347 lbs.	4371 lbs.
Payload rating	1400 lbs.	1400 lbs.	1400 lbs.

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of a voltmeter calibrated like a fuel gauge—F to E—and a d.c. ammeter. The ampere gauge indicates when the batteries are fully charged during plug-in periods.

The rest of the dash contains conventional auto controls like windshield wipers, defroster, headlights and high beams, directional signals, horn and heater.

### Driving for two cents a mile

Despite its limited range of 40 miles, and its low top speed of 38 mph, learning to live with the Comuta-car is a remarkably pleasant experience.

The routine of plugging in every night and checking the electrolyte once a week becomes second nature very quickly. Unlike a gas engine, it has no sparkplugs to clean, oil to change or timing to be set. And best of all, you will never have to worry about the engine not starting. As long as the batteries are charged, you're always ready to go.

The greatest satisfaction of electric-car ownership is knowing you will never have to stop at a gas pump. Instead, you have the convenience of plugging in at your home

outlet. No special wiring is needed because the Comuta-car is charged on regular house current. And the cost? It's about the same as running a 40-watt bulb all night. In New York that works out to about 80 cents per charge. Given the 40-mile range the net cost per mile is *two cents*.

During the time that we had the electric car, my wife Lillian and I almost ignored our regular car. The Comuta-car fulfilled almost all of our local transportation needs and we only fired up the gas burner when a long trip was called for.

### Ideal urban car

The Comuta-car, or any limited-range electric car, is an ideal urban car. Where a gasoline-powered car is most inefficient, stop-and-go driving, an electric is very efficient because it uses no power while stuck in traffic or waiting for traffic lights.

Because of its size, it can fit into parking spaces that are too small for even the tiniest subcompact cars. In addition, there is enough room behind the two seats for four grocery bags, which makes it great for shopping.

For short-range hauling, this little wedge has got to be one of the cheapest modes of transportation. But if you're thinking of buying one, my only word of caution is don't stray far from home.

For more information about this car, contact General Engines Co. Inc. 591 Mantua Blvd., Sewell, N.J. 08080.

FM

### A HANDSOME HYBRID

(Continued from page 87)

springs instantly into motion, accompanied by the quiet hum of an express elevator and the loud clicking of relays.

The Hybrid, rushed to completion, still has a few bugs in it. One is the noise. The gasoline engine sounds like a lawnmower and the clicking of the relays is annoying. Both can be easily remedied, however. The car also needs a buzzer to warn that the electricity is on, so the driver doesn't accelerate unless he means to go, and to warn him to turn it off again before exiting the car.

The dual capability of the Hybrid seems to be the perfect answer to the limitations of pure electric cars. While it won't free us completely from dependence on oil, it is certainly a step in the right direction.

Now, since Briggs and Stratton doesn't plan to manufacture the Hybrid, we'll just have to wait for a large auto manufacturer to produce it.—Virginia DeMoss



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The folks in East Grand Forks, Minnesota are used to floods. Perched at the meeting point of the Red and Red Lake Rivers, they get a big one every spring as the snow swollen waters run into ice blocks up north. But the town's mayor, Louis Murray knows how to handle it. As soon as the rivers begin to rise, he sees that the U.S. Coast Guard is notified.

"It's really terrific," Mayor Murray says. "Call the Coast Guard up at 9:00 AM and they're here right on time...some twenty of them with half a dozen boats and all their equipment loaded up on trucks...their expertise is certainly welcome."

For two, sometimes three weeks, the Coast Guard helps East Grand Forks fight their annual flood. They sandbag dikes, run a ferry-boat service between strategic points and rescue people—not to mention an occasional dog, cat or chicken—who have been stranded by the water.

The Coast Guard stays until



Mayor Louis Murray

the flood waters subside and everybody is safely returned to their homes. And East Grand Forks is grateful. As Mayor Murray puts it, "I don't know what we'd do without the Coast Guard."

But it's all in a day's work when you're in the Coast Guard—protecting lives, helping others. Whether it's fighting floods in East Grand Forks, Minnesota,

preventing an oil spill in the Caribbean, or enforcing federal laws in our coastal waters. And when it comes to helping yourself, there are a lot of great jobs in the Coast Guard. In fields like electronics, mechanics, navigation, aviation, communications and seamanship. And the Coast Guard gives you all the training you need to get your career off the ground.

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Lost and hidden valuables are buried all around us! The Techna XR9, a sophisticated Transmitter/Receiver metal locator, reaches thru dirt, sand, even solid rock to help you *find* those valuables! And with Techna's unique (Patent Pending) Dual Phase Discrimination system, you don't waste time on junk! Everytime you discover something, the XR9's micro-computer circuit instantly analyses the find and flashes a *Green* indicator light for coins, jewelry, and other valuables, or a *Red* indicator light for nails, foil, bottle caps, and other junk!

With the XR9 you can find a *single* coin up to 10 inches deep, a bag of coins up to 2 feet deep, and larger objects up to 6 feet deep!

The XR9 is ruggedly constructed with an all aluminum case and control deck. Detector indication is with a large viewmaster meter, clear-tone loud speaker, and the exclusive Dual Phase lights. Features include built-in battery tester, headphone jack, comfortable hand grip, and adjustable aluminum stem. Tuning is fast and easy for anyone.

### TELL TREASURE FROM TRASH!

Whether for family fun or serious treasure hunting, XR9 is the one! If you are not entirely pleased, return the unit within 30 days for a full refund. Comes with Full one year Limited Warranty (Copy on request) and complete instructions.

**TO ORDER:** Send check or money order For \$189.95, plus \$6.00 for shipping and handling To:

DESIGN FORMAT, 11900 Montana, El Paso, TX 79936.

## THE PM GARAGE

(Continued from page 12)

and inconvenience of large commercial units. Black & Decker has solved the problem with a compact plug blaster that offers the same results as larger units. And the best thing is you can plug it into the cigaret-lighter socket of your car. That means you can do all the plugs right on the fender without any running around.



Compact sparkplug cleaner gives professional results, plugs in lighter socket.

The plug blaster comes with enough grit for a dozen uses and a plug-gapping tool. It costs about \$20 and is available at auto-parts stores or in the auto departments of general merchandisers.—T.A.

### Helmet security

At last you can leave full-face helmets with your motorcycle and rest assured that it will still be there when you return. A device called the



HelmetLock has room for two helmets and folds out of the way when it's not in use.

HelmetLock by CycleTogs clamps onto any tube on the bike and lets you lock the helmet in place. It uses triangular-headed bolts, which can't be removed without the use of a special tool that's supplied with the unit. It is priced at \$19.95, and is available from CycleTogs International, Box 19414, Portland, Ore. 97219—T.A.



# Thousands across nation using Ohio man's sure-fire way to get rich quick

Are you an 8 hour a day working person? Do you have little or no savings in the bank? Are you in debt with mortgage, car payments and charge accounts? Do you have little experience at anything except the small specialty of your job?

If you've answered "yes" to all these questions, you are a prime candidate for a foolproof get rich quick system developed by a working man from Canton, Ohio. His name is Benjamin Swarez and he was in your exact same position not long ago. But, he changed all that by inventing a get rich quick system designed especially for the working man.

**How did this system come about?** You probably already know about Mr. Swarez and his system. Ads on his system and stories about Mr. Swarez have appeared in nearly every major newspaper and magazine in the country. Thousands of people across the nation have purchased the system and the stacks of letters from satisfied customers received by Mr. Swarez are overwhelming.

Mr. Swarez did not develop his system overnight. But his final, perfected version certainly does generate income overnight.

**Mr. Swarez's first successful system netted him \$80,000 clear.** What's it like to get \$80,000 almost overnight in one lump sum?

"It's almost impossible to verbalize. My wife and I just stared at the check for a long time. We had a two day celebration with a dinner and party. Then I went into work and told my smug boss, who thought he had me under his thumb, where he could stick his low paying, lousy job. Next we paid off all our bills including our house mortgage and had a burn-the-mortgage party.

The following day we went to an auto dealer's showroom and laid down cash for a new luxury car. I never had the experience of a new car even as a child."

"Then my wife and I went on a shopping spree for clothes. We had been making do with old clothes for so long they had become worn out. She always had to shop for clothes with very little money. I always joked with her that 'If I gave you \$5,000 to spend on clothes could you do it in one day?' She used to say 'I could do it in a couple hours.' So that's what I did. I gave her \$5,000 to go out and buy clothes. It ended up taking all day and she said she relished every minute."

"Finally, we took a long trip. In New York I bought her a large diamond at Tiffany's — another thing we always dreamed about."

"But I can tell you that the money was not the most important benefit in this. What money really does is give you precious time. Time to be with your wife and children before they grow up before you know it — and time to do things you really want to do. Another priceless thing you gain is your self respect. No more crawling and kneeling because you're dependent. The words of Frank Sinatra's song 'My Way' says it all."



Benjamin Swarez

**How much money can you make and how fast can you make it?** Mr. Swarez averages around \$200,000 for each system he produces. He says doing a system to make \$10,000 or \$20,000 is literally duck soup. "I

have these available to me all the time and don't even use them," he says.

**How fast can you make money?** Mr. Swarez stated, "You can actually make money within hours in some cases. You can compile a system in one afternoon one day and start having spendable money in your hands produced by the system the very next morning."

**Who all can do it and how sure fire is it?** Mr. Swarez says, "I've done it 14 times in a row now. I taught my younger brother and brother-in-law the system and they've already made over \$500,000 each. All you need is the ability to follow simple directions, common sense, and the ability to see a job through to completion."

This system is also perfect for people who are confined to homes, such as housewives. Mr. Swarez named his system "7 Steps to Freedom". He has been selling his system to others for a year now. The reason? "Why not?" he says. "First I thought I'd have to keep it secret. But then I found out the system can't be saturated, so why not sell it and make money by selling the system on top of the other money I am making using it."

**People from every state in the union have purchased Mr. Swarez's system.** What do these people have to say? Here are just a few comments:

"... It is such an excellent product that anyone who can read and follow instructions can be a millionaire. ..." — William J. Bontrager, Peoria, IL.

"... This is the first time I have purchased a 'get rich' product that I sincerely feel will work." — Earl J. Davis, Chicago, IL.

"... Adjectives alone cannot describe its hidden wealth. After many years, much money and a bellyfull of frustration, I believe I have found an honest man, and yes I truly mean it." — John T. Vaughn, Norridgewock, ME.

"I have just received your system and have taken it to college. It has really lifted some eyebrows especially the first and last parts..." — Mark Kimble, Rockhill, SC.

**A word to the doubting Thomases.** Of course there will be those who will doubt that the system is for real. Mr. Swarez has featured this system in nearly every newspaper in the country and he has sold his system to thousands of people across the nation and in every state of the union. The story has been checked repeatedly by newspaper reporters and government authorities at literally every level. The story checks out. Every word he has stated about his system is true or he would've been out of business long ago.

**You can make \$100,000 in a matter of weeks or days. In some cases money starts in hours. Here's how it works...**

**1** You will receive Mr. Swarez's system in the mail which contains everything you need to complete one of your own systems. From anywhere, such as your kitchen table, you complete the preliminary steps. This involves filling out provided forms and following provided outlines.

**2** The preliminary steps of the system are done only one time. After these preliminary steps, you can do the steps for each individual system anywhere, from your home, while you are traveling. (Mr. Swarez does his individual systems in his motorhome) or from a favorite vacation spot. Again, by following outlines and filling out forms, you complete your individual system (each of which is in two parts, Part A and Part B).

**3** After completing Part A and Part B of the System, depending on the type of system you do, you may either phone in Parts A and B of your individual system, or you drop it in the mail. In the type of systems where you phone in Parts A and B, you can virtually complete a system one afternoon and have spendable money in your hands the very next morning.

**4** In a matter of days or weeks, depending upon which system you do, you can receive \$100,000 for each system. In some cases, over 80% of the money will be in your possession in less than a week. Your money will either be deposited in your bank account or brought to you by mail to your home or your vacation spot.

For those who wish to purchase the N.P.G.S. System, called "7 STEPS TO FREEDOM", it is being distributed by mail only for the present. Mr. Swarez has kept the price of the system low so those who most need it can afford it.

To order: (1.) Get a blank piece of paper (2.) At the top of the paper, print the words "7 Steps to Freedom" (3.) Print your name and address (4.) Mail this along with \$20.00 in cash, check or money order to Quality Consumer, Dept. G-168 ; 706 Twelfth St. N.W.; Canton, Ohio 44703.

Or, if you want us to start processing your order immediately, phone in your order as follows: (1.) Dial this TOLL FREE number, 1-800-321-0888 (Ohio residents dial 1-800-362-0636) and ask for operator G-168 ; (2.) Say the words "7 Steps to Freedom, N.P.G.S. system" (3.) Give your name and address (4.) Give the operator one of your following credit card numbers: Master Charge or Visa (also include your Interbank number). Or, if you don't want to use a credit card, tell the operator you want it mailed C.O.D. Operators are on duty right now and around the clock.

Direct any inquiries to (216) 452-0868. Please do not dial the toll free number for information. The operators are not permitted or qualified to answer questions.



# Best knots for the new fishing lines

Four combinations fit to be tied for a tight, no-slip grip on the latest synthetics.

by Homer Circle

**H**ere are four hot knots selected especially for the tough new fishing lines now being introduced. Improved plastics are making the latest lines tougher, longer wearing and more abrasion resistant, but some knots can slip and come untied or reduce rated test strength by cutting through as they tighten.

Many record fish have been lost because a knot failed at a crucial moment. An angler can buy the newest technology in fishing line, but it will only be as good as the knot that connects him to his catch. If your pet knots have never failed, fine. Try them with the new lines. A good test is to tie your knots on one lure and the ones shown here on another. Pull them against each other; then you can be certain. My four favorites should fill most fishing needs.

## Bimini twist

The Bimini twist is my choice when you are fishing the newly popular ultralight tackle and using



Testing Stren monofilament line, DuPont's Instron machine records break strength.

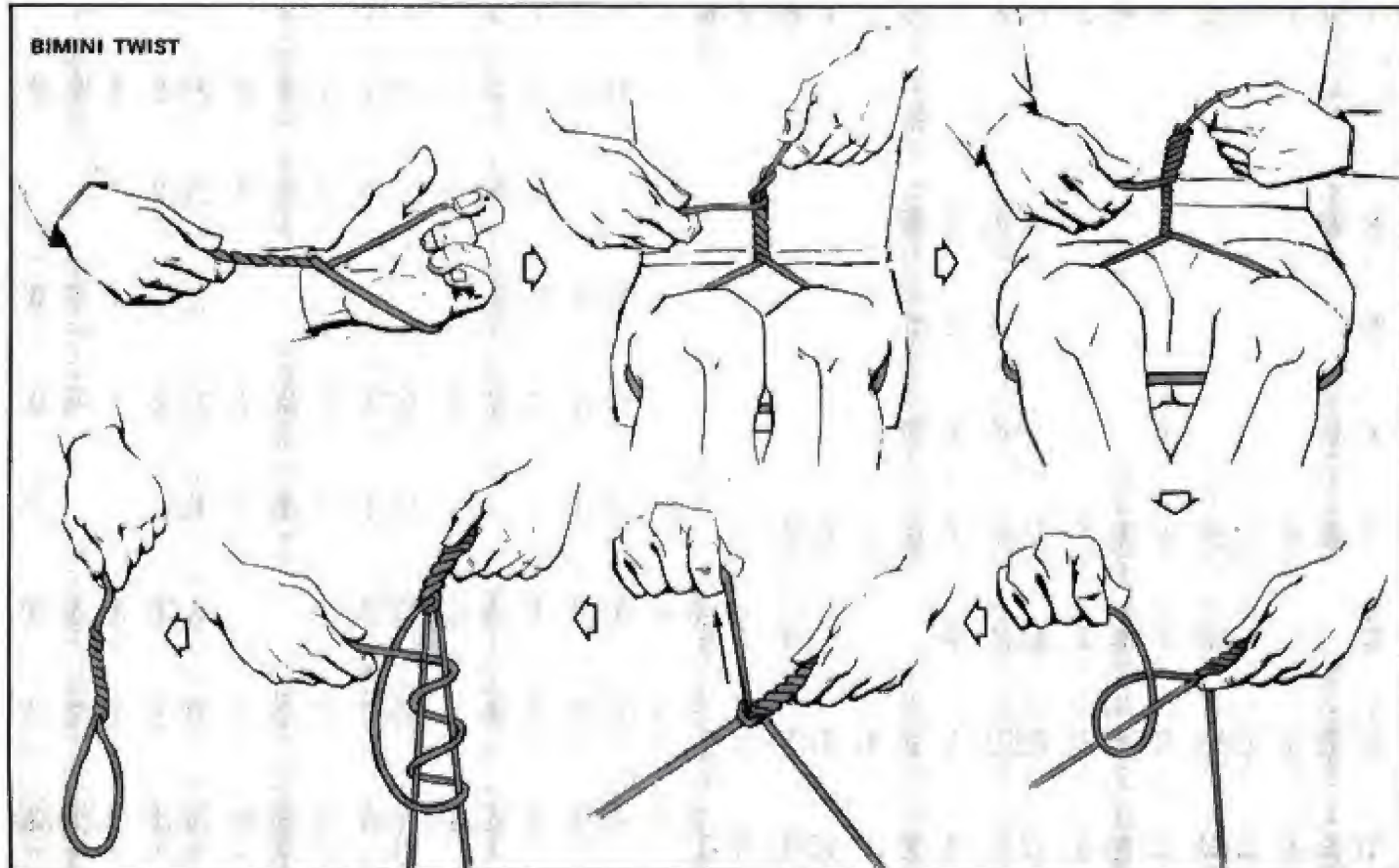
light lines which might break. It enables you to double the strength of the terminal end of your line. The knot originated in saltwater, is offi-

cial for record catches, and tests 100 percent of your line's pound-test.

It looks complicated, especially if

*(Please turn to page 190)*

## BIMINI TWIST







## Imagine. An oil that goes 25,000 miles without a change.

Mobil 1\* synthetic motor oil is the oil that saves you gas. It's also the oil that saves you oil changes.

Because with Mobil 1 you can go an incredible 25,000 miles or one year whichever comes first on one oil change.\*

Now that's one incredible claim. But that's only fitting. You see, Mobil 1 is one incredible oil.

Mobil 1 lubricates better than premium oils to help your engine

run smoother and last longer.

And because it's a synthetic oil, Mobil 1 doesn't break down as fast. And that means you can go longer—a lot longer between oil changes.

Imagine an oil that goes 25,000 miles between oil changes and saves you gas to boot.

We can't imagine why someone would use anything else.

**Mobil 1 The oil that saves you gas. And more.**

\*Adding oil as needed. New car owners follow warranty requirements. Diesel and Turbo owners follow manufacturer's instructions. © 1980 Mobil Oil Corporation.

MOBIL 1 IS A REGISTERED TRADEMARK OF MOBIL OIL CORPORATION.



# Doctors Prove You Can Help Shrink Swelling Of Hemorrhoidal Tissues Due To Inflammation. Relieve Pain And Itch Too.

**Gives prompt temporary relief from hemorrhoidal pain and itch in many cases.**

Doctors have found a most effective medication that actually helps shrink painful swelling of hemorrhoidal tissues caused by inflammation. In many cases, the first applications give prompt relief for hours from such pain and burning itching.

Tests by doctors on hundreds of patients showed this to be true in many cases. The medication the doctors used was *Preparation H*®—the same Preparation H you can get without a prescription. Ointment and suppositories. Use only as directed.

**What you don't know about these water and fuel savers could cost you over**  
**\$200 a year!**



*Easy-to-install kit dramatically cuts water and fuel costs!*

**Only \$29.95**  
plus \$2.50 handling

## SHOWER

Patented shower head offers a forceful, pleasantly tingling shower, but uses only 2.1 gallons of water per minute rather than the 5.8 used with common shower heads, reducing those water and heating fuel costs up to 60%!

## FAUCETS

Bath and Swivel-Kitchen faucet aerators cut water use from 3 gallons to 2.2 gallons per minute at normal household pressure. Fuel and water savings of up to 50%!

Figures above are based on average water and water heating usage for a family of four.

## TANK

Toilet tank water saver cuts water use from 5.7 gallons per flush to only 3.3½ gallons per flush without loss of pressure! Saves up to 20% on water bills.

**Don't wait, call toll free!**  
**800/323-5038**

In Illinois call (312) 272-3270 collect to place an order on your Visa, Master Charge or American Express.

Or send \$29.95 plus \$2.50 for shipping and handling to:

**Resource Conservation Technology**

P.O. Box 248, Northbrook, IL. 60062.

Illinois residents add 6% sales tax.

**NO RISK!** Refund if not totally satisfied, return within 15 days of receipt of product. If further information is desired, please write or call the above for complimentary brochure.

## BEST KNOTS FOR NEW FISH LINES

(Continued from page 178)



Abrasion resistance of new lines is found by pulling over sandpapered dowel.

you're a tad fumblefingered, but it's worth the practice.

Double the end of the line to form about a 2-foot loop. Place loop over one hand and rotate it 20 times to put twists in line.

Holding in the twists, place your knees together and put the loop in the line over them. Hold tension on the main line as you pull back and down on the tag end, letting it drop over the twists.

Spread your knees apart, increasing tension, and pull slightly downward on the tag end as you increase knee pressure. As you ease tension on the tag end, it will wrap down over the twists entirely.

Place your index finger in the "V" of the loop and throw a half hitch over one side of the loop. Pull half hitch up tightly. The twists are now secure so you can relax pressure.

Make a three-wrap hitch around both lines and pull up snugly. Clip off the tag end right against the knot. With practice, you can vary the loop size to fit your needs.

## Brinson knot

This knot was impressed upon me by another knothead, Billy Brinson, a fishing guide at Santee Cooper, S.C. It broke all my other pet knots, so I've been using it since. It tests to 95 percent plus of line strength.

First, insert the line through the eye of the hook; do it again to make a double loop. Lap a loop with the tag end against the standing line, holding it with thumb and forefinger. Make five wraps with the tag end

(Please turn to page 182)



# STOP CAR THEFT— AUTOMATICALLY

Your car is an easy mark for the joy-riders and small-time strippers who account for 70% of all auto thefts. Locked car doors can be opened quickly and easily with a slim-jim. Ignition locks can be defeated with a slide-hammer in as little as 30 seconds. In other words, a thief can break into your car and drive it away without much risk of attracting attention. After its last ride, your car will be stripped and abandoned. That's a high price to pay for being a little easy.

**What Can You Do?** Until now, there wasn't much of a practical solution to the problem. You had to turn your car into a rolling electronic fortress to get the protection you wanted. That meant drilling holes, mounting locks, adding switches, stringing wires, and installing ugly alarm boxes. That's a lot of work, and a big mess.

**Which Mess Is Best?** In spite of the inconvenience, you still may not get the theft protection you want. What if you get lazy about turning the alarm on and off—especially when the weather is bad and you're "only going to be in the bank for a minute." A system that drains your car battery of its starting power while it's on standby isn't really protection at all. And, a sophisticated system that sounds off whenever a loud truck rolls by or when there's a random voltage drop in the car's electrical system doesn't exactly inspire confidence. After a few dozen false alarms, your neighbors may be convinced that you and your car are safer without an auto alarm.

In fact, with most auto alarm systems, the best thing you can hope for is to mess up your car's electrical system and appearance so much that nobody will want to steal it—or own it. What you need is a simple, effective alarm system that will discourage the would-be thief without discouraging you. You need to get ARMED™, the mobile alarm that won't mess up your car or your life.

**Why?** ARMED™, the ultimate mobile alarm, is a creation of computerized digital electronics, and it can think for itself; it doesn't need to be turned on or off. That means no added locks or control switches, and that means no drilling. Once the alarm is installed, you'll never see it or touch it. In fact, the ARMED™ alarm is so sophisticated that it has been granted 8 claims to patent by the U.S. Patent Office.

**What Does It Do?** Here is how the ARMED™ system works. When your car door is opened, ARMED™ begins counting down an owner adjustable Entry Delay. This Entry Delay allows you



MADE IN U.S.A.

to enter your car and use your key to turn the ignition "on" (or to "ACC"). This stops the Entry Delay countdown and disarms the alarm. In other words, you enter, start, and drive your car as always. When a thief breaks into your car, the Entry Delay will elapse and the alarm will begin sounding before he can break the ignition and manipulate it into an "on" condition. The alarm will attract attention and scare the thief away. The last thing these opportunists want is attention. Even if all the doors are relocked, the alarm will sound for two minutes and then reset itself. If a thief decides to come back, he will get the same treatment. When you turn the ignition off, the ARMED™ alarm begins an Exit Delay countdown of two minutes. This should be enough time for you and your friends to exit comfortably and close all doors. If you need more time, simply leave the ignition in the "on" position until the car is unloaded. At the end of the Exit Delay, the alarm sets itself and goes into standby condition, waiting to validate the next entry. You get constant automatic protection and freedom from extra locks and switches.

**Inconspicuous Consumption:** The ARMED™ alarm will not give you a dead battery. In standby condition, ARMED™ consumes only 1 microamp of current. At that rate it would take 2,000 years for ARMED™ to drain a typical car battery of its starting power. Statistics show that most cars won't even last that long.

**Flexibility:** The ARMED™ alarm is extremely versatile. It will accept addi-

tional **Instant** alarm triggering from many sources, such as switches on hoods, trunk lids, glove boxes, storage compartments, gas flaps, CB's, sound systems, or any other equipment or enclosure you wish to protect. ARMED™ will also accept instant or delayed alarm triggering from seat switches, motion detectors or similar devices. The alarm output will activate any relay-controlled car horn or other type of noisemaker.

**Easy to Install:** The ARMED™ alarm was designed for the do-it-yourselfer. No drilling or other vandalism is required. The alarm module splices easily into the wiring system found in most cars. All connections are made with simple snap-on wire splicers, and a complete, fused, alarm wiring harness is supplied. Every clearly described installation step includes a built-in self-test to prevent mistakes. Even the test light is included. The alarm module has an adhesive backing for quick, secure, concealed placement under the dash.

**Hi Tech = Low Price:** In today's market the consumer is offered more technology for less money than ever before. The ARMED™ alarm (AL3B), complete with detailed instructions, fused wiring harnesses, snap-on splicers, test light, and window decals costs only \$49.95. That's cheaper than many less intelligent alarm systems; it's certainly cheaper than another car. For some Fords and a few imports without the necessary horn relay, a convenient relay package (RK1A) is available for \$9.98.

**Discouragement Plus!** Now you can add a new dimension to ARMED™ protection. Engine Lock™, the ultimate accessory, will not allow your car's engine to start once the ARMED™ alarm has begun sounding. Even though the alarm resets, Engine Lock™ will not release until the hidden remote reset is activated. You hide the remote reset wherever you like, and you'll never have to touch it unless someone has tried to steal your car. In that case, you'll be grateful for the minor inconvenience.

**An Easy Option:** Engine Lock™ attaches easily to your ARMED™ alarm system, and everything needed for a quick installation is provided. Engine Lock™ can disconnect either the starter circuit, electric fuel pump, or electronic ignition, or it can close a fuel solenoid or short out a Kettering point ignition. But remember, Engine Lock™ gets its operating signals from the ARMED™ alarm module, so it cannot be used by itself. Yet it can be added to your ARMED™ system at any time. The Engine Lock™ module (EL1A), complete with instructions, connectors, wiring and remote reset is \$34.95.

**Insurance Discounts Possible:** ARMED™ is known in the auto insurance world as a PASSIVE alarm because it offers constant, automatic protection. ARMED™, especially when used with Engine Lock™, may qualify for the comprehensive discounts offered by many insurance companies for PASSIVE alarm systems. These discounts can go as high as 15%. Sometimes being passive pays off. Check with your own company to be sure.

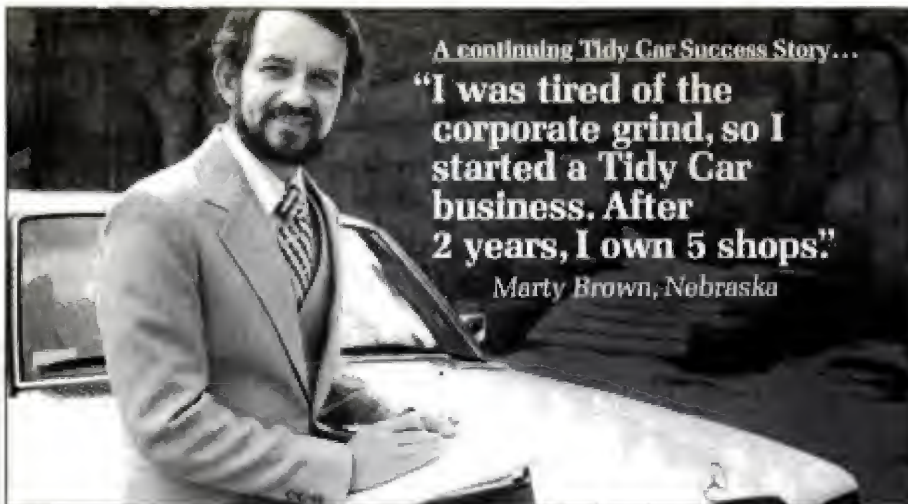
**Satisfaction Guaranteed:** If you don't like what we send you, you can send it back within 30 days. Units found defective in materials or workmanship will be repaired or replaced without charge for a period of 2 years from date of purchase.

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TOLL-FREE ..... 1-800-323-1717  
ask for operator #27 and mention product numbers (In Illinois call 800-942-8881) or send check or money order including \$2.50 for shipping and handling (Tenn. residents add 6% sales tax) to:

**Hi-Tech Marketing  
2 Vantage Way  
Nashville, TN 37228**

a division of  
Digequip Security Industries, Inc.





### A continuing Tidy Car Success Story...

**"I was tired of the corporate grind, so I started a Tidy Car business. After 2 years, I own 5 shops."**

*Marty Brown, Nebraska*

Marty Brown's Tidy Car business has been a success almost from the very beginning. After only nine months in the business he started a second shop location. In two years he now has five Tidy Car locations, giving superior car appearance maintenance services to car owners throughout the Midwest.

Looking back a short two years, Marty still remembers working 65 hours a week in charge of cost accounting for a large company.

"I simply wasn't being compensated enough for the tremendous pressures of balancing budgets and preparing forecasts for 107 company branches," he explained. "Plus, when I considered the real hours I was working and the expense of my college education, it just wasn't worth it."

"I looked into starting my own accounting office, leasing vehicles, even owning a golf course. Then I read about Tidy Car."

### Start for less than \$1500.

"The income potential was there... with almost no initial cash outlay. I could start the business for \$1500. I didn't have to borrow anything. In fact, I was able to generate enough income in the first three months to build my whole business."

"I don't shine cars myself anymore. In fact, after the first six months, I had eight operators working for me while I managed the business."

"What you know about cars initially doesn't matter so much as your ability

to manage. Tidy Car has a tested formula outlined in their owner's manual, so there's virtually no gamble to this business. There's nothing I've found to compare to it. The market is there, the numbers are there. People are keeping their cars longer so they need to maintain them better. We keep increasing the appearance maintenance services we provide."

"You can apply Tidy Car's Preserv-A-Shine® paint sealant; apply new car upholstery protection treatments; revitalize vinyl roofs; clean and protect fiberglass, plexiglass, you name it. And, while we're mostly talking about family cars, there's business in boats, RVs, even aircraft."

### Mail Coupon Today!

The Tidy Car world-wide dealer network includes over 2,000 independent businessmen. If you'd like to join them, mail the coupon today to find out if you qualify. Find out more about how you can win with Tidy Car!

Gary Goranson, Pres.  
Tidy Car Inc., Dept. PM6  
3918 Broadway  
Cheektowaga, NY 14227  
(716) 850-2820

☐ I'm interested in Tidy Car! Please send me your free 20-page brochure on how to win with Tidy Car!

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Address \_\_\_\_\_  
City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_



## BE A CHIMNEY SWEEP

**Your Own Business:** A chimney sweep can clean a chimney with the August West® System in one hour. Nationally, the average charge is \$40.00.

### A Growing Need:

The energy crisis has resulted in a dramatic increase in wood burning. Wood smoke deposits form a sticky creosote in chimneys. Regular cleaning is necessary to prevent fire damage.

### The August West® System:

More sweeps are in than any other method in the country.

Send for our free booklet, or call TOLL FREE any time and ask for "The August West Story."

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Box 613 — Dept. PMR  
Worcester, CT 06090



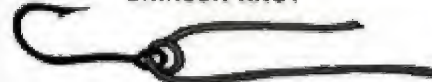
## COIN GRAB BAG FREE!

**GIANT SURPRISE COIN ASSORTMENTS** packed grab-bag style from collectors including rare, scarce and valuable coins up to 2000 years old! A real exciting treasure hunt; unopened, unsorted—just as they are received—no 2 assortments, exactly alike! Nobody knows what's in them, but each guaranteed to contain our guarantee \$9.00 catalog value or more for only \$6.98 plus 75¢ p.p. each. Our Super Size \$18.00 minimum catalog value or more only \$13.49 plus \$1.00 p.p. each. FREE! Order 4 of either size, get 1 same size FREE! Ideal gifts for beginner or advanced collector. Handsome illustrated 32 page Guide, Catalog & Price List included FREE with order, otherwise \$6.98.

MATT HUMISS, Dept. PM66, Great Neck, N.Y. 11022

**\*Partial List of Coins in Collections:**  
Half & Large Cents  
Flying Eagle Cents  
Indian Head Cents  
Two Cents  
Three Cents  
Liberty Nickels  
Shield Nickels  
Buffalo Nickels  
Half Dimes  
Seated Liberty 10c  
Barber Dimes  
Seated Liberty 25c  
Barber Quarters  
Seated Liberty 50c  
Barber Half Dollars  
Walking Liberty 50c  
Civil War Tokens  
Coins of the World

### BRINSON KNOT



### BEST KNOTS FOR NEW FISH LINES

(Continued from page 180)

and then run it through the loop.

Let the tag end hang free while you pull the hook and standing line in opposite directions. Loops should fold over themselves to form a neat, tapered knot against the eye of the hook. (Note: Occasionally, the loops just don't go together properly. You can tell because the knot will break as you snug it up tightly. Practice should enable you to do it properly nine times out of ten.)

### Palomar knot

This knot, designed by a Californian named Chet Palomar, is so simple. (Please turn to page 184)

### PALOMAR KNOT





# HOW TO MAKE \$10,000 A MONTH AG FLYING!



**AND TAKE OVER SIX MONTHS VACATION A YEAR!  
WITHOUT A COLLEGE EDUCATION OR EVEN A HIGH SCHOOL DIPLOMA!**

The pilot of the airplane in this picture can make \$10,000.00 in a month.

Sounds too good to be true, doesn't it? But I can make \$10,000.00 a month, and I never went to high school. So why can't you?

You don't need years of training to do what I do. You don't need large sums of capital. But there is a catch. You have to be able to fly an airplane. If you don't think you would like to fly—perhaps this is not for you.

But if you are already a pilot, or would like to become a pilot, then read on. This may be the best opportunity of a lifetime.

If you have a commercial pilot license, I can show you how you can prepare yourself to earn up to \$10,000.00 A MONTH, in just a few short weeks.

If you are not a pilot—don't despair—I will tell you how you can become one in 90 days or less!

Let me introduce myself: my name is Jim Ward. I have a very unusual occupation. My services are so much in demand that I can make \$5,000.00 to \$10,000.00 a month working four to six months a year. Then I take a six-month vacation!

I am an agricultural pilot. Ag pilot for short.

Let me explode some myths about ag flying.

Perhaps you think it is dangerous? Wrong. There is no need for it to be dangerous, IF you have the proper attitude, and a little training in how to avoid the common hazards. I have been doing this work for over 23 years and I have never had any kind of accident! So, it can't be that dangerous, can it?

Maybe you have heard that it is a hard business to break into? Wrong again. I became an ag pilot just 20 days after deciding I wanted to get into this BIG MONEY occupation. I took a 10 day course, and 10 days later, I got my first job!

Previously, I was a starving flight instructor. I switched from instructing to ag flying and increased my earnings TENFOLD in the first week!

To be an ag pilot you do not have to be licensed to fly by instruments. You do not need a multi-engine rating. You do not need a lot of hours. 200 hours total flying time is enough in most cases. You do not have to do any aerobatics.

And yet you can make more money than most airline co-pilots. Even more than some captains.

Interested? O.K. To help people like you break into the BIG MONEY in a hurry—AND SAFELY—I have prepared the one and only indispensable guide on how to get into this profession. It is called, "HOW TO MAKE \$10,000.00 A MONTH—AG FLYING!"

In this guide, I lead you by the hand and reveal all the little secrets about this ag flying game that I have learned in my twenty three years of experience.

I show you:

- How to become a pilot in less than 90 days
- How to get training almost free if you are a veteran
- How to finance lessons if you are not
- How to prepare yourself for ag flying when you have your license
- How to fly low safely
- How to spray a field
- How to fertilize
- How to mix chemicals
- How to load your airplane
- How to make farmers happy
- How to make your boss happy
- How to get that first job
- How to get into the big money

**AND MUCH, MUCH MORE!**

Now if you have read this far, I want you to do yourself a favor and ACT NOW.

**SEND FOR MY MATERIAL TODAY,**

because tomorrow, or next month, may be too late. I can't promise that this ad will appear again. If you wait until another day, you may forget to order, or you may lose the magazine or the address. This moment, NOW, may be your one chance to find out what this ag flying business is really all about.

SO, ORDER NOW, while you're thinking about it. Take any piece of paper and write the words "HOW TO MAKE \$10,000.00 A MONTH—AG FLYING." Then put your name and address on it and send it with a check or money order for \$20.00 to:

**AGRICULTURAL PILOT SERVICES, INC.  
DEPT. PM-1, P.O. BOX 650-929  
MIAMI, FL 33165**

Or, if you prefer to use your MASTER CHARGE OR VISA CARD, CALL (TOLL FREE) 1-800-327-8456 and ask for EXTENSION 9. Give the operator your name, address and credit card number. (In Florida call (305) 444-7173). Sorry, but the operators are not qualified to answer questions about the material.

If you order my material TODAY, I will include, ABSOLUTELY FREE, a list of OVER 100 COMPANIES, and agricultural aircraft operators who hire ag pilots. (These lists are normally sold for \$10.00 to \$20.00. GET YOURS FREE, while they last. This offer may not be repeated.) So HURRY, order "HOW TO MAKE \$10,000.00 A MONTH—AG FLYING!", TODAY.

We also run an ag pilot school and complete training program, but that is another thing that you will learn about when you receive my material.

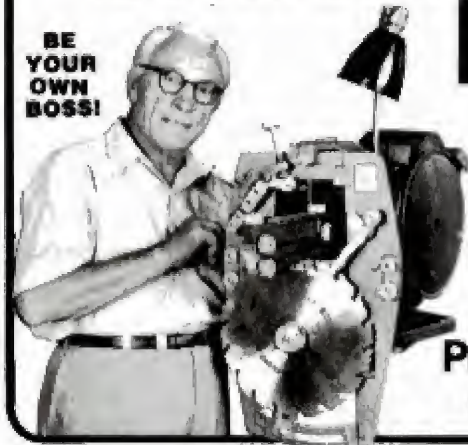
**MONEY BACK GUARANTEE:** You may examine my material for 10 days, and if you are dissatisfied for any reason, just send it back, in good condition, and we will cheerfully refund your money.

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Now you can cash in on the huge demand  
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OWN  
BOSS!**



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**or more. Work part time,  
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**No layoffs. No strikes.**

**Provides a steady source  
of year round income.**

**This can be one of the most  
important decisions you ever make**

Going into business for yourself can be the most exciting and rewarding decision you're likely to make in your lifetime.

Owning your own business brings you a sense of independence. You're the boss, setting your own work hours. Your own effort builds the business for yourself and your family. You can achieve great satisfaction and profits, if you choose and manage your business wisely. That's why so many men, just like you, are cashing in on the big profits to be made in this fast-growing service field.

The sharpening business allows you to get started with only a minimum investment, requiring little space and effort for a successful operation. It lets you build and expand as fast, or as slowly as you like. You pocket most of the money you take in, because there are exceptionally high profits with no investment in merchandise.

If you need only \$200 or \$400 extra income each month, a sharpening business is ideal for spare time. The additional dollars can be SPENT for more of the good things of life. Or they can be SAVED in a rainy-day fund that the family can bank on.

**More sharpening businesses are  
needed every year**

As original equipment continues to climb in cost, owners are becoming more concerned that the equipment be maintained so that it performs like new. This means more companies, contractors, carpenters and home owners are having their old saw blades and tools resharpened many times, where in the past, they would have replaced them with new blades or tools. This is where you

can step in with the much needed service of sharpening saws and practically any kind of tool.

**SEND FOR FREE FACTS TODAY!**



**This FREE  
booklet has  
helped  
thousands**

Thousands of good men have been inspired by this fact-filled book into making that first important step of starting their own

business. It can be yours just for the asking.

*It covers these important subjects...*

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- Age, education not a factor
- No selling is required — customers bring their business to you
- Lawn mowers and chain saws
- Sharpening business is year-round
- Sharpening opportunities in small towns and large cities
- A sharpening business provides excellent retirement income
- How Foley helps you start
- No experience needed, any age can succeed

**Act today, so you can have a  
brighter, more secure tomorrow**

Right now, while this is still fresh in your mind, fill-in the coupon below. We will send your FREE copy of "Opportunities in a Sharpening Business of Your Own". There is absolutely no obligation and there are no franchise fees in starting your Foley Sharpening Business.

Send your name and address to: Foley Manufacturing Co.  
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**Foley**

☐ **YES**, I would like to receive complete details about how I can easily start a profitable, Foley-equipped sharpening shop. Please rush me your FREE booklet, without any cost or obligation, that gives me full details on how I can quickly start my own business.

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**ADDRESS** \_\_\_\_\_

**CITY** \_\_\_\_\_

**STATE** \_\_\_\_\_ **ZIP** \_\_\_\_\_

**BEST KNOTS FOR NEW FISH LINES**

*(Continued from page 182)*

ple anyone should be able to tie it once he has seen it demonstrated. It checks out above 96 percent and should be used for tying line to a hook, swivel or snap. It is not quite as handy as the Brinson knot when tying to the eye of larger lures, since the loop must slide over the entire rig. But use it because it's a beaut.

Double the end of your line about a foot and insert the loop through the eye of the hook.

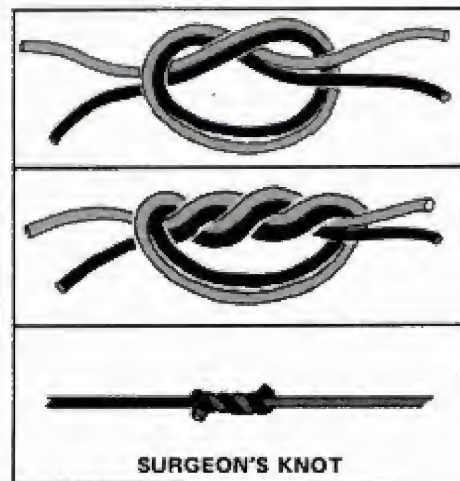
Tie a simple overhand knot in the double line. Slide the loop over the end of the hook or lure. Pull hook and line in opposite directions to snug the knot. Clip off the tag end.

### Surgeon's knot

When you need to join two lines, or tie a leader to your line, this knot is as functional as it is simple, and can handle lines of different diameters. It makes a small knot that will not bump going through your guides and thus lasts much longer.

Lap the two lines for about a foot and tie a simple overhand knot in the doubled lines. Pull it up until it forms a small loop.

Hold the loop open and tie a second overhand knot, as illustrated



**SURGEON'S KNOT**

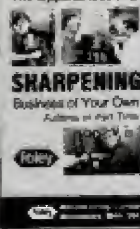
(above). Grip the double lines at each end of the loop and tighten slowly.

Snug the knot tightly. Then release the tag ends and tighten further by pulling on standing ends. Clip tag ends against knot. It won't slip.

When tying with a doubled line, keep the lines parallel and don't let them twist. As you make the final draw down, make certain the coils pull up in a neat spiral. Pulled up too quickly, they can overlap and cut each other. Tests on DuPont's Instron machine show that slippage in a loose knot is the main cause of failure. Snug each knot so tightly it won't slip.

**FM**

The Opportunities in a



**FREE  
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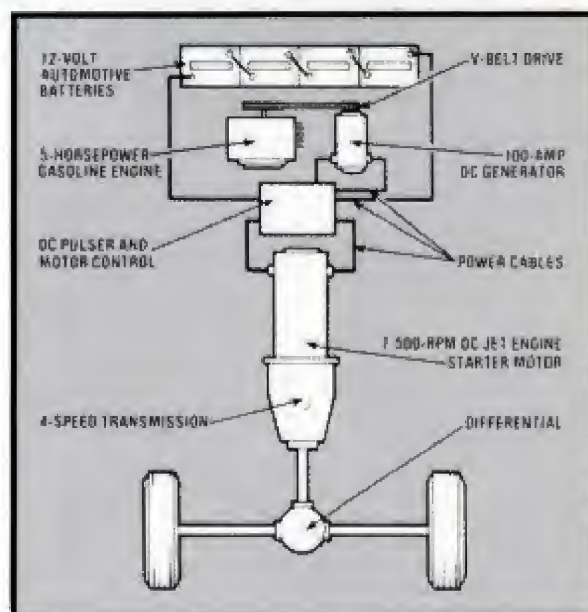
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David reports 75 miles per gallon from his vehicle. He began with a 1970 Opel GT, and the plans list 14 other makes and models among many that are suitable candidates for the conversion!

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All you do is take your existing car (or buy a used body) and replace its original powerplant with a small gasoline-powered lawnmower engine. (That's right, a lawnmower engine!) This engine drives a 100-amp generator which supplies the vehicle's drive motor with electricity.

When more power is needed, four automobile batteries—hooked up in series and fed by the generator—give you plenty of kick for passing, for climbing hills, and for running at normal highway speeds.

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Your total conversion cost—when you buy the parts and build it yourself—is about \$1,500. Your first year's benefits alone—in fuel savings and in hassle-free driving—can more than repay the expense.

Because of the tremendous demand, **THE MOTHER EARTH NEWS®** now offers you a detailed, step-by-step set of plans for making the **HYBRID ELECTRIC CAR**. The complete package includes the plans, bill of materials, and list of suppliers . . . sells for \$15 . . . and comes with a no-risk guarantee: If after ten days you decide not to use your plans, you can return them for a full refund.

## HERE'S HOW TO ORDER . . .

1. Fill in the coupon below. **PRINT** your name and address. If the coupon is missing, you may order on a separate sheet of paper, on which you write the words "HYBRID ELECTRIC CAR PLANS" and your name and address.
2. Make your check or money order payable to **MOTHER'S PLANS**. North Carolina residents add 4% sales tax. Canadian residents add 15% surcharge to cash orders. No charge for regular shipping, but please allow 6 weeks for delivery. (For faster service, add \$1 for first class postage.)
3. If you prefer to charge it to BankAmericard/VISA or Master Charge, include your name, your account number, the expiration date on the card, and your signature. (For Master Charge, give the Interbank Number.)
4. Mail your order and remittance to: **MOTHER'S PLANS**, Dept. 400101, P.O. Box A, East Flat Rock, N.C. 28726. (Sorry, no COD's, but you are fully protected by our 10-day, no-risk, money-back guarantee of satisfaction.)

YES! Please send me \_\_\_\_\_ sets of **HYBRID ELECTRIC CAR PLANS**. I understand that if for any reason I am not 100% satisfied with the plans, I may return them within ten days for a full refund.

Ship to:  
NAME \_\_\_\_\_  
(please print)

ADDRESS \_\_\_\_\_

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# Ion Fountain™

**YOUR ULTIMATE AIR FRESHENING/  
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LOW PRICE. STATE OF THE ART.**



Breakthrough. The new Ion Fountain™ is in a class by itself. This negative ion generator gives you power to saturate your home or office with billions of refreshing ions. Without fans or any moving parts it puts out a pleasant breeze. A pure flow of ions pours from the top like water from a fountain, filling your room. The result? Your air feels like fresh ocean air—pure, crisp, and wonderfully charged.

The price? **Only \$79.95.** That's a price breakthrough because no other company can offer you a unit with higher ion output or better quality than the Ion Fountain™, even at triple our price.

## HOW CAN WE DO IT?

Six years of experience helps. Plus a lot of ingenuity, aggressive research and a personal commitment to give our customers the best we can.

UTP Ion Research Center is a branch of our educational publishing company. And our commitment in publishing to give birth to new ideas and methods that enrich humanity is part of the Ion Research Center too. We're in business to serve you and your environmental needs.

## WHAT ARE IONS?

Ions are electrically charged atoms in the air with either a positive or negative charge. The sun and cosmic rays as well as lightning and fast-moving water (like waterfalls, surf) generate trillions of negative ions every day. The more negatively ionized the air, the fresher and more alive it is. Air pollution, artificially controlled climates (with air conditioning and heating) and electronic equipment all produce excess positive ions, depriving the air of these small negative air ions and creating dead "stuffy" air.

## WHAT'S THE SOLUTION?

Our rapid-growth technology, which sometimes takes its toll on the quality of our air, has also come up with the solution. Following Nature's model of the thunderstorm which uses a high electrical charge to purify, revitalize and stimulate the air, the UTP Air Energizer has been developed imitating this process. Both the thunderstorm and the Air Energizer fill the air with negative ions, restoring the natural electrical balance to the polluted, energy-depleted air. But the Ion Fountain can be used indoors in the home, office, workshop, laboratory, etc., keeping a fresh supply of ionized oxygen available night and day. This new breakthrough in fresh air control is not a cover-up

which masks or deodorizes. The unit actually removes the dust, smoke, bacteria and pollen particles from the air by attaching ions to them and causing them to sink to the earth where they can be vacuumed up rather than inhaled. At the same time ions electrically stimulate the energy-stripped air.

## YOUR CHOICE OF TWO TOP-QUALITY UNITS!

There's only one unit that's better than the Ion Fountain. That's our own Executive System Four™. It sells for \$159. It has an even higher ion output. Plus! Our special **Dial-An-Ion** feature allows you to adjust the ion output anywhere from low to high. Not everyone knows that the need for ions varies. A large smoky room will require higher output than a small room. And some people want fewer ions while sleeping than while working. The new Executive System Four is our answer to this need for output flexibility.

## FACTS YOU NEED TO KNOW The Ion Fountain™—System Five

<b>Ion density:</b>	430,000 ions per cm <sup>3</sup> /sec. at 1 meter. 1.55 million ions per cm <sup>3</sup> at 50 cms.
<b>Use:</b>	Large room or office—9000 cu. ft.
<b>Warranty:</b>	1 year
<b>Output voltage:</b>	15KV
<b>Ozone:</b>	Less than 2 parts per billion
<b>Dimensions:</b>	5 1/2" x 4 1/4" x 2 3/4"

## Executive System Four™

<b>Ion density:</b>	Low to maximum of 540,000 ions per cm <sup>3</sup> at 1 meter. 1.6 x 10 <sup>6</sup> ions per cm <sup>3</sup> at 50 cms.
<b>Output voltage:</b>	15KV
<b>Ozone:</b>	Less than 2 parts per billion
<b>Dimensions:</b>	11" x 5" x 4"
<b>Use:</b>	Large room or office 10,000 cu. ft.
<b>Warranty:</b>	1 year

If the Executive System Four is better, why did we bring out the Ion Fountain? Not everybody is willing to pay \$159 for an air ionizing unit, no matter how good it is. Just like not everyone drives Rolls Royces. Most drive less expensive cars. The Executive System Four is for the person who wants the

absolute best quality and doesn't mind paying a little extra to get it. If you want highest ion output, flexibility, and a beautiful oak paneled case, buy the Executive System Four.

If you want something at half the price of the Executive System Four, but still better than any other units costing up to \$250, buy the Ion Fountain.

## HOW TO GET ONE

To place your order now just send a check for \$79.95 plus \$3 shipping for the Ion Fountain. Or send \$159 plus \$4 shipping for the Executive System Four. Tell us your full street address as we cannot ship to Post Office boxes. (California residents add 6% sales tax.)

Our unit is dependable and trouble-free, but if by rare chance any problems occur our service-by-mail center sends off your unit within 24 hours of receipt or sends a replacement so you are not without fresh air and can enjoy your dust-free environment. And each Air Energizer is backed by a full one-year limited warranty.

## HOW TO GET ONE FAST

Credit card holders can call our toll-free number below. Order a unit now and if you are not satisfied with its effects within 10 days simply return it for a full cash refund. Order your Air Energizer today.

# UTP

Read "The Golden Egg"

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but made to pass strict commercial  
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- C.S.A. - Meets all safety requirements of Canadian Standards Association (stricter than U.S.)!
- N.S.F. - Commercially approved by National Sanitation Foundation (for restaurants, institutions).

Compare all the wonderful features of this superb oven with any other brand! Then compare our price. Prove to yourself what a sensational value this is! If you EVER thought of getting a new microwave oven, RIGHT NOW is the time to do it!

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**PATENTED BEAM STIRRER!** For more even distribution of microwaves; more thorough, uniform cooking.

**LARGE CAPACITY!** Big, 1.30 cu. ft. interior can hold an 18 lb. turkey. Can cook entire meal at one time! Has a special pyro-ceram glass bottom for your convenience.

**FULLY PROGRAMMABLE!** A solid-state, electronic mini-computer lets you program cooking in advance!

**5-STAGE MEMORY!** Program up to 5 separate oven cycles at one time. Appropriate panel lights up to inform you as each new cycle starts. Oven works in proper sequence even if programmed in wrong sequence!

**ELECTRONIC DIGITAL TIMER!** Set cooking time for a few seconds or up to 99 minutes, 99 seconds. The five second buzzer signals completion of cycle.

**L.E.D. DIGITAL CLOCK!** Shows time of day, power level, cooking time, temperature setting of meat probe.

**10 SEPARATE POWER LEVELS!** For every type of cooking need... from slow cooking all the way to fast.

**PROGRAMMABLE DELAYED COOKING!** Leave the house for up to 12 hours and the oven will start all your programmed cooking instructions BEFORE you return.

**DEFROST CYCLE!** Quickly defrosts a roast, turkey, ham, etc., in a fraction of normal time.

**4 SAFETY INTERLOCKS!** Microwaves immediately shut off when door is opened.

**EASY CLEANUP!** Vinyl coated acrylic interior will not streak or stain; wipes off clean and new-looking. Cook on glass, china, paper, plastic, even ON aluminum foil.

**SAVE ON LEFTOVERS!** Leftovers are quickly heated to a delicious "just cooked" flavor! Dried out bread and bakery goods are restored to "just baked" freshness. Cold coffee reheats without a boiled, bitter taste.

**GREATER NUTRITION!** Microwaves' speedy cooking RETAINS MORE of the vitamins and minerals so essential to good health! Foods shrink less, too.

**SAVE ON ENERGY COST!** Save 40% to 90% on the energy cost of cooking (depends on type of food item).

## PUBLIC NOTICE!

Because we are the nation's largest mail order liquidator of consumer products, famous manufacturers often come to us with special, big closeouts.

There are many reasons for their closeouts, such as: last year's models, discontinued products, financial difficulties, plant closings, etc., etc.

We liquidate huge inventories to the public at a fraction of the normal retail price! Sometimes we are allowed to advertise the brand name and reason for the closeout. Sometimes not.

In the case of these ovens, we had to replace the original major brand name with our own private label. But we can tell you this much: These are all brand new, factory perfect, made in U.S.A. Over 200,000 were sold under the original brand name at \$789.00!



We have liquidated over 9,000 microwave ovens, including these famous brands: Tappan, Panasonic, Toshiba, Caloric (made by Amana). But NEVER have we been able to offer such a sensational, money saving low price on an oven as superb as THIS one!

### JUST TAP IT TO PROGRAM IT!

**L.E.D. DIGITAL DISPLAY** - Shows time of day, cooking time, power level... at your command.  
**NUMBER SELECTION** - Tap the ones you want for cooking time, power level, meat probe temperature, time of day.  
**SIMMER** - For medium energy.  
**WARM** - For lowest power setting on sauces, yeast bread, to soften butter and cheese, to keep foods warm.  
**POWER LEVEL** - Tap it before selecting any of 10 different power levels.  
**TEMPERATURE PROBE** - Tap it before setting desired temp. for meat probe.  
**REST** - Lets time pass between cycles.  
**THAW** - Uses 50% of power for thawing or for cooking delicate foods.  
**COOK** - Produces 700 watts power for fastest cooking cycle.  
**CLEAR** - Cancels out any information you previously programmed.  
**CLOCK** - Tap it to display time of day.  
**DELAY** - To delay start of your cooking instructions up to 12 hours if desired.  
**START** - Just tap to start the functions you programmed.



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Send \_\_\_\_\_ Omega Microwave Oven(s) at the liquidation price of only \$339.00 each. I will pay shipping charges to the driver upon delivery. (Allow up to 5 weeks for delivery. If paid by personal check, allow extra 2 weeks for check to clear bank.) Sorry, no C.O.D. orders.

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# Now you can mix your way to better sound

Mixers have long been known to the serious audiophile, but you don't need a million-dollar system to use them. We show you how to choose—and use—these often neglected audio components.

by Bill Kanner



The Teac mixer/meter combination (above) solves all but the most complex mixing problems. There are inputs and outputs for nearly every purpose. With meters, mixer goes for about \$725. Audio-Kit 62 (left) is a build-it-yourself mixer that offers 6 inputs, 2 outputs for \$300.

**T**o some people a "mixer" is something you put in a highball, while to others it means a certain kind of fraternity party. But mention the word "mixer" to a dyed-in-the-wool audio buff or a well-biased recordist and it means something else entirely. To them a "mixer" is a junction box for microphones and line inputs.

A typical mixer has sliders, buttons, knobs and often meters. It also has the remarkable ability to send into rapture any dedicated audio enthusiast. But why the ecstasy over something that's basically a junction box?

A mixer takes a signal, alters it only slightly and sends it on its way

*(Please turn to page 190)*



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This book tells you where to buy wind power systems — the cost — the best size for your city or farm home. It details how to build your own system. Frank Buyak of Pound Ridge, N.Y., built his own system in 1974 for under \$1500. Under today's tax credit for installing energy-saving devices (legislation now in Congress seems sure to raise this to 50%) you can get the government to pay up to half the cost of your installation.

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Comprehensive plans and detailed illustrations show you how an under \$200 installation, working on winds as low as 7 MPH can provide lighting, heating and pumping. The book also shows you how to utilize solar units when the wind is down.

#### PROVEN PERFORMANCE OF WIND POWER SYSTEMS!

- Norman Page of Pelham, Mass., spends \$30 a year (for parts) to run his windmill and it provides power for his lighting and appliance needs. When an electrical storm in Pelham blacked out all homes, offices, and factories, Mr. Page's personal wind power system kept right on working!
- A Windmill is now generating power for a five-story tenement building on East 11th Street in New York City (see photo) and they are selling their excess power to the Con Edison utility.
- Three wind machines are presently being installed in the State of Washington that will provide all the power needed for 2,000-3,000 homes.



It's easy to install a windmill next to your home that will provide light, heat & run all your appliances — plus a surplus to sell to your utility.



Windmill atop apartment house in New York City

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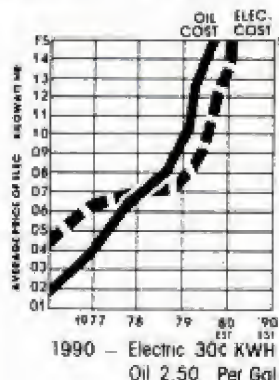
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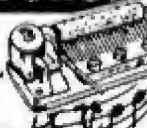
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412 Main St. Ave., New Jersey 07112 Page 8



## MIXING FOR BETTER SOUND

(Continued from page 188)

virtually unchanged. It simply  
takes a signal at the input and lets it  
out the other end as an output.

The answer is partly in the sex ap-  
peal of the sliders, knobs and meters  
and partly in what they allow you to  
control. With an ordinary stereo  
tape recorder, you can plug in two  
microphones and have one picking  
up signals for the left channel and  
the other for the right. On most ma-  
chines, there is no provision for  
blending those channels or for add-  
ing other microphones. A mixer  
changes that. You can have a vari-  
ety of microphones (or other input  
sources) giving you signals that you  
can blend together or keep relative-  
ly separate. You can alter the vol-  
ume or "gain" of each input and  
even change the tonality of each in-  
dependently.

## Mixing at home

Mixers first came to prominence  
with the development of rock music.  
They had been used to balance re-  
cordings before then, but the '50s  
saw the coming together of a num-  
ber of elements in popular music.  
Les Paul's electric guitar and over  
dubbing with a multitrack tape re-  
corder meant that you could record  
many instruments, voices or elec-  
tronically produced sounds, keep  
them separate for as long as you  
wanted, and then combine them in a  
desired fashion.

The mixer became the intermedi-  
ary controlling element in recording  
sessions. It kept the input sources at  
given levels and combinations could  
be grouped. Then, once the desired  
material was on a multitrack  
master, the mixer could be used to  
take that information and combine  
it into two tracks or channels for the  
final stereo version.

That makes a mixer a necessity  
for the professional recording engi-  
neer, but why would the ordinary  
audiophile want one?

As sound equipment has gotten  
better, more and more people have  
been getting into the act. They ei-  
ther want to record themselves or  
they have friends in a band. Increas-  
ingly, audio gear that was originally  
intended for use by professional  
sound technicians has filtered down  
to the amateur.

With a mixer, a good set of micro-  
phones and a good tape deck, the en-  
thusiastic hobbyist can make tapes  
that are virtually indistinguishable  
from a studio production. And with  
today's musical styles, you can al-  
ways connect two turntables to your

(Please turn to page 192)



# JC WHITNEY & CO. Introduces ... A Custom-Tailored CAR COVER for EVERY CAR!

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## MIXING FOR BETTER SOUND

(Continued from page 190)

mixer and turn your next party into  
a disco.

Other than that kind of novelty,  
isn't a mixer an extravagance? Sure  
it is—unless you really intend to do  
some live recording. More and more  
audiophiles are finding that home  
studio-type recording is the next  
logical step for them. It provides a  
level of creativity not otherwise  
available. A mixer allows versatility  
and individual expression and need  
not be a big investment compared to  
the rest of the system.

A good open-reel tape deck (the  
kind most used for serious live re-  
cording and editing) will cost a mini-  
mum of \$500. If that's the kind of  
equipment we're talking about, then  
the additional cost of a small mixer  
is, on a percentage basis, no great  
investment.

### Build it yourself

If you're willing to do a little work  
yourself, you can get a more than  
adequate mixer for under \$300. Au-  
dioKit 62 is a British mixer kit dis-  
tributed by AudioMarketing of  
Stamford, Conn. As the name im-  
plies, it's a 6-in/2-out unit. That  
means that you can take up to six  
high-impedance inputs, mix them as  
desired, and end up with two chan-  
nels at the output. The 62 takes  
about eight hours to build.

The AudioKit 62 has a variety of  
controls and features. Each input  
channel has a gain control that acts  
as a microphone amp, bass and tre-  
ble controls, as well as cue and echo  
controls. The last two are for external  
equipment and are connected to  
outputs on the back panel. Each  
channel has a pan pot, which can ap-  
portion each input to either or both  
channels. A slider controls the  
amount of signal going to the output  
stage.

In addition to the cue and echo  
outputs, the 62 has main and auxil-  
iary pairs of outputs. The main set  
(which you connect to your tape  
deck) is controlled via slider and its  
level is reflected in VU meters. The  
auxiliary outputs are knob-con-  
trolled.

The AudioKit 62 is flat and can be  
carried in a briefcase. And while its  
optimum power source is its 24-volt  
d.c. power supply adapter, it can run  
successfully for hours on two 9-volt  
batteries. The kit sells for \$285, in-  
cluding the power supply.

Want to play with a few more out-  
put channels? Teac has just the item  
for you. Its Model 2A accepts micro-  
phone or line inputs of either high or

(Please turn to page 194)





Attractive Air Alive unit measures only 4½" x 4" x 1¾" and cleans a 20' x 15' x 8' room in up to 15 minutes.

# AIR ALIVE

**Uses "Nature's Air Cleaners" to electronically destroy odor, smoke, dust, and pollen. Now research shows it may do more!**

Little-understood particles, called negative ions, are said to be nature's best air cleaners. They attach themselves to dust, smoke, pollen or anything else floating in the air, and cause it to fall harmlessly to the ground. Now there is growing proof that negative ions may affect your moods, health and sense of well being.

## THE ION CONTROVERSY

For the past 20 years, scientists and scholars-world wide have been studying the effects of electronically charged particles in the air called negative ions.

Russian scientists have recently proven that the presence of ions in the air is essential to animal life. Research conducted at the University of California has shown that plant growth is stunted when the ion content in the air is decreased.

Some researchers claim there's evidence that negative ions can relieve allergic ailments and headaches, help control virus, retard the growth of bacteria, increase mental alertness and energy, reduce pain, tension, fatigue and depression and produce sound sleep.

Interestingly, while the number of those who believe that negative ions do, in fact, produce these benefits, has grown, the number of doubters has decreased over the years.

## THE ION IMBALANCE

The air is made up of molecules that contain either a majority of electrons, making them negative particles, or a majority of protons, making them positive particles.

Although nature produces a nearly equal number of positive and negative ions, there are a number of reasons why we are surrounded by an over abundance of protons: air pollution depletes the number of negative ions in the air, the static charge from synthetic fibers produces positive ions and natural earth radiation, that would normally produce negative ions, is retarded by concrete and asphalt covering the land.

In effect, we are breathing air that nature never intended us to breathe ... air that has been depleted of negative ions. What is needed is a way to correct this ion imbalance.

## NATURE'S AIR CLEANERS

There is almost no disagreement among scientists that negative ions are unmatched in their ability to cleanse the air of impurities. This is how they do it: negative ions attach themselves to dust, smoke and pollen, neutralize them and cause

them to fall harmlessly from the air.

Engineers and doctors have recently recognized this benefit and have begun to take advantage of it. Many now use commercial units that emit negative ions and effectively destroy odors and pollutants in the air.

It has only been during the last year that technology has developed an affordable consumer model. These units were first introduced in Europe where there is a high level of interest in the benefits of negative ions.

Now we are introducing one of the first consumer units to be sold in this country!

## ONE OF THE FIRST UNITS UNDER \$100

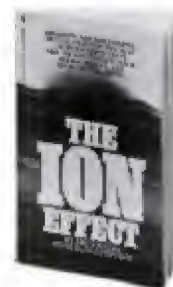
When we were offered the opportunity to introduce Air Alive to the American market, we jumped at the chance! Why? Because it's one of the first consumer models in this country to be sold for under \$100. And because it's manufactured by Western Systems, Inc., a pioneer in the ion generation field.

## MOST COMPACT UNIT ON THE MARKET TODAY

Air Alive measures only 4½" x 4" x 1¾" and puts out 3 trillion negative ions per second per cubic centimeter. That's as many or more than larger, more expensive units now on the market. It is so powerful that it cleans a 15' x 20' x 8' room in up to 15 minutes. Air Alive brings you more cleansing power in its compact size.

## WARRANTED FOR TWO FULL YEARS

Air Alive is an all solid state unit ... it has no moving parts. The unit is so trouble free that it is warranted by Western Systems, Inc. for two full years, in the unlikely event that anything should go wrong.



## FREE BOOK JUST FOR TRYING AIR ALIVE

Just for trying the Air Alive unit, we are offering a 160 page book entitled "The Ion Effect".

**Absolutely Free!**

It is yours at no additional charge. It's yours to keep even if you should return the Air Alive unit during our 30 day trial period. "The Ion Effect" traces one man's 10 year effort to discover the truth about the effects of ions. Judge for yourself the benefits of negative ions.

## OPTIONAL AUTO ADAPTER

Now Western Systems, Inc. brings something new to the American market that Europeans have used for years ... an optional auto adapter that allows you to use your Air Alive home model in your car, truck, van or RV. Hardware included for mounting under your dashboard and adapter plugs into your cigarette lighter.

## 30 DAY NO-RISK TRIAL

We believe Air Alive to be the most compact negative ion generator on the market today. It will destroy the dust, smoke, pollen and odors in the air in your home, office or car.

And we want you to decide for yourself whether or not you can benefit from the effects scientists are claiming that negative ions can have on your health and sense of well being.

We offer you a 30 day, no risk trial period on every Air Alive unit you order. If during that time you decide the Air Alive unit does not meet your expectations, for any reason, you can return it for a prompt refund of the purchase price.

## TO ORDER YOUR AIR ALIVE

Simply fill out the coupon and send it, along with your check or money order, to the address below. For even faster service, call Toll Free: 1-800-527-7066. In Texas call (214) 349-3120.

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## MIXING FOR BETTER SOUND

(Continued from page 192)

low impedance and has a mike attenuate position that cuts the microphone amp's power. Each input has its own bass and treble controls. Color-coded pushbuttons allow you to assign any input to any or all outputs, and pan pots allow you to control the output of any input channel relative to the output.

The back-panel outputs are equally versatile. The quarter-inch microphone-inputs are supplemented by standard RCA-type line-input jacks. Above the line inputs are cue outputs that give you the signal before the input fader. They can give you a check and some insurance for another mix should you need a backup.

The dual set of line and auxiliary jacks both come after the last amplification stage—after the master fader. They give you the final signal. But the 2A also has patch points for auxiliary equipment.

The 2A has yet another set of jacks labeled "Buss In." This set can be used to gang or stack a series of mixers and control them via one master fader. You might find that the initial six inputs on your 2A are not enough and you want to use a larger mixer.

You'll notice that while the Model 2A is a sophisticated piece of equipment, it has no meters. It's not that Teac feels meters are irrelevant. Quite the reverse. Teac makes the MB-20 meter bridge, which is basically a set of four VU meters with switching and inputs and outputs.

You can use the MB-20 quite effectively. Along with the 2A, it forms a control console. The mixer's line outputs feed the tape deck. A set of four tape-in jacks provide a monitor function (front-panel selection for each channel) and four jacks provide line signals for the mixer.

As professional-type mixers go, the combination of a Teac Model 2A mixer, at \$475, and an MB-20 meter bridge, at \$250, is a real bargain. It yields all the versatility and quality most of us are likely to need. If the combination ticket is a little steep, think about getting the AudioKit 62 or just starting out with the Teac mixer and using your deck's meters. Add the Teac meter bridge later.

If the idea of recording your own sound appeals to you and you're tired of the results you're getting with microphones through your tape deck, take a serious look at a mixer. It doesn't have to cost a fortune and can give you just the creative control you need. Besides, it could well be the life of your next party.

PM





# Small Fridge. Big Deal.

## FROM ONLY \$129.

**Space age breakthrough creates a new line of Koolatron electronic portable refrigerators and food warmers.**

You're nicely away on your long-awaited vacation, camping trip or long weekend with the family. You're comfortably cruising in your car, van or rec. vehicle along a busy interstate with few rest stops or restaurants. You guessed it... the kids want to stop for a snack. But your Koolatron P34 or P34A is full of sandwiches, cold pop, fried chicken... home made, fresh and cold. The family helps themselves and you've saved valuable vacation time and another expensive restaurant bill.

You're a commuter, a salesman or a trucker and you spend many hours in your vehicle daily. Now with your amazing Koolatron P10 plugged in beside you, you open the lid and instantly fresh food and drinks are at your fingertips. Just for the price of a good cooler and one or two seasons of buying ice, (or about 10 family restaurant meals), all the marvels of home refrigeration are available electronically. An amazing space-age miracle... the thermo-electric solid state module... makes these portable refrigerators possible.

These amazing heat pumps have not only gone to the moon, but have provided the breakthrough for Koolatron's portable fridge revolution.

### THOUSANDS IN USE

Koolatron now has tens of thousands of electronic fridges in use worldwide using these same powerful solid state modules. Built to take it, two of these electronic modules are encased in tough, plastic insulated chests that are designed to be rugged and trouble-free. Non-rusting hinges and latches prevent corrosion in salt water environments. And with only one moving part (a small 12 volt fan) Koolatron's portables seldom see a service depot. Now you can enjoy Koolatron's whole family of electronic portable refrigerators and food warmers that eliminate costly ice and provide "home refrigeration" convenience at sane and sensible prices.

### MODEL P10 - CAR FRIDGE & FOOD WARMER

**\$129.00**  
(in Canada \$139.00)



Holds approx. 17, 12 oz. pop cans - refrigerates in air temps. up to 95°F. Also keeps hot foods hot (150°F) at the flick of a switch. Deep rich blue Polypro plastic case. Ext. 16" L x 11" H x 11 1/2" W. Int. 11" L x 8" H x 8" W. with 10 litre capacity (11 qts.) weighs 10lbs. empty. Operates from supplied 12 volt power cord in vehicles or with optional 12VDC/110VAC power adaptor.

As a travel fridge the P10 keeps foods and beverages fresh and cold wherever you go. Carry insulin, medical samples, dietetic foods. Great for private planes and golf carts. Photographers use it for films. Mothers... now you can refrigerate baby's formula in your car then heat it with the flick of a switch or keep it cold. Powerboaters, just plug it into your boat's cigarette lighter to keep a day's food and drink ice cold without going ashore for ice. With your engine off, you can operate for up to 8 hours and still start your engine. "A low battery" indicator warns you when it's time to recharge. With the power off, your P10 keeps everything hot or cold for many hours in its well insulated case.

With our optional 110 volt adaptor you'll also find endless uses wherever house current is available... at your cottage... as a bar fridge... in your motel room for a midnight snack and drink... as a small office fridge... or beside your pool. Use as an auxiliary home fridge when you're having a party.

### MODEL P34 - RECREATIONAL FRIDGE

**\$169.00**  
(in Canada \$179.00)



Holds over 40 lbs. of food and beverages or 48 pop cans. Refrigerates in air temperatures up to 95°F. Rugged ABS case in sand beige color with dark brown non-corroding latches and handle. Large 34 litre capacity (1.2 cu. ft.) weighs 17 lbs. empty. Ext. 21" L x 16" H x 16" W. Int. 16" L x 12" H x 11 1/2" W. Operates on 12 volts DC with supplied power cord or with optional 12VDC/110VAC power adaptor.

The P34 is the full-size member of the Koolatron family of portable electronic fridges. It is designed especially for the serious traveler and outdoorsman and will refrigerate more than 3 times the contents of the P10. As a hunter, camper, boater, you'll be amazed at the capacity and convenience. Fits into any boat, van or camper or back seat of your car. Plugs into your cigarette lighter receptacle and refrigerates over 40 lbs. of food (no space wasted by ice), yet it draws no more power than the P10. With our optional 110 volt adaptor, you'll find endless uses as a bar fridge, cottage fridge, office fridge. Your P34 has all the advantages of the P10 without the heating cycle or low battery indicator but with all the capacity needed by the outdoorsman.

### MODEL P34A - ULTIMATE RECREATIONAL FRIDGE AND FOOD WARMER

**\$189.00**  
(in Canada \$199.00)

The same size, color, weight and capacity as the P34 but includes food warming features, fully adjustable temperature control and low battery warning indicator.

The P34A is our top of the line portable. It heats, it refrigerates and with specially designed electronic circuit control (patent applied for) it allows you to dial a complete range of temperatures from very cold to very warm. You wine buffs will find it indispensable to chill up to 1 doz. wine bottles at just the right temperature. Low battery indicator warns you when you need a recharge and the sensing circuits efficiently control your power consumption to save on battery drain. This is our best-of-the-line, recreational fridge and food warmer with all the bells and whistles for the discerning buyer who demands quality, size and complete versatility. Use from a cigarette lighter receptacle or plugged into house current with our optional 110 volt adaptor.

### ORDER TODAY WITHOUT OBLIGATION!

Simply complete the attached order form or phone collect and we'll rush you your portable on our no risk 21 day trial offer. Each unit comes with complete instructions and a written 1 year warranty. In the unlikely event you ever need service, we have major service centres in New York, Arizona and Canada. When you receive your Koolatron, use it constantly for 3 full weeks without risk.

If you ordered our optional 110 volt adaptor, plug it in, then use your portable immediately as a bar fridge or around the patio or pool. Next plug the fridge into your car or RV. Take your family out for a weekend trip. Enjoy fresh home-cooked food as you thumb your nose at those expensive restaurant stops. If after you've thoroughly tested it, you don't agree that your Koolatron represents a major breakthrough that will save you time, money and bother for years to come, send it back for a full refund. You can't lose... we guarantee it.

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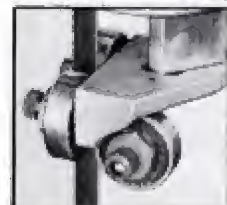
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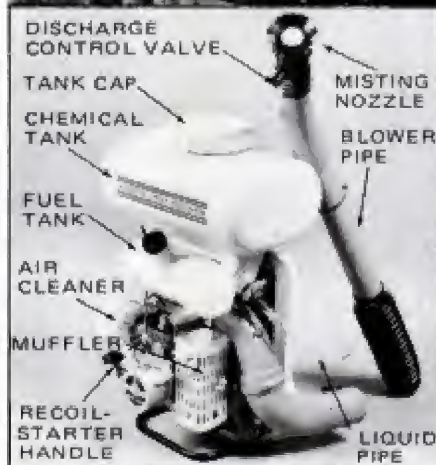


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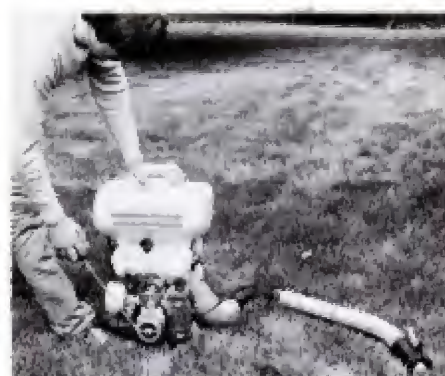
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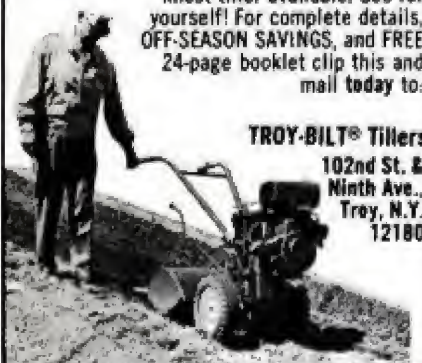
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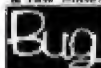
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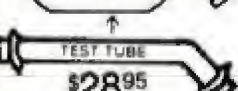
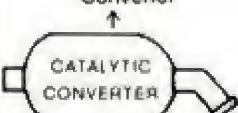
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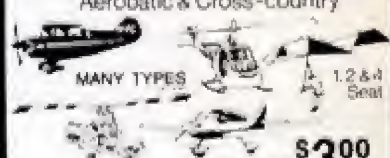
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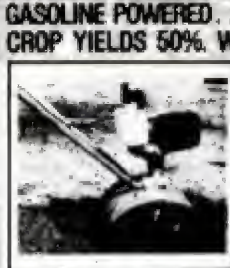
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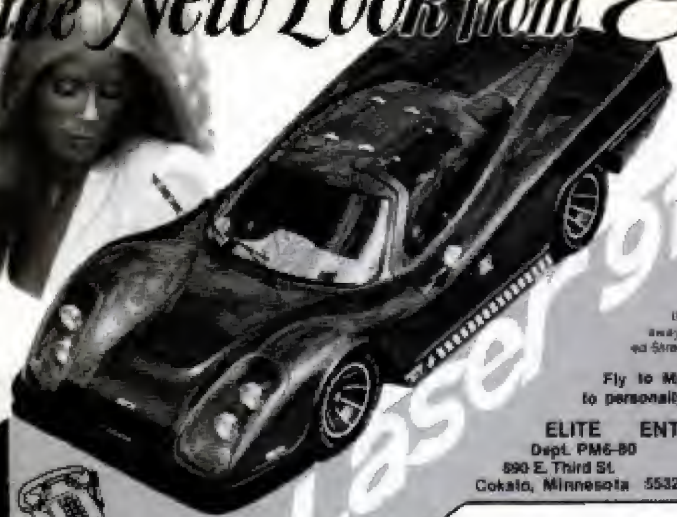
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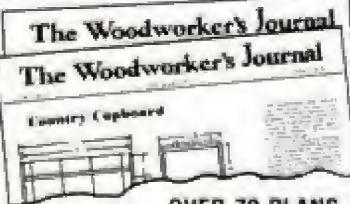
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(Continued on next page)



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(Continued from preceding page)

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